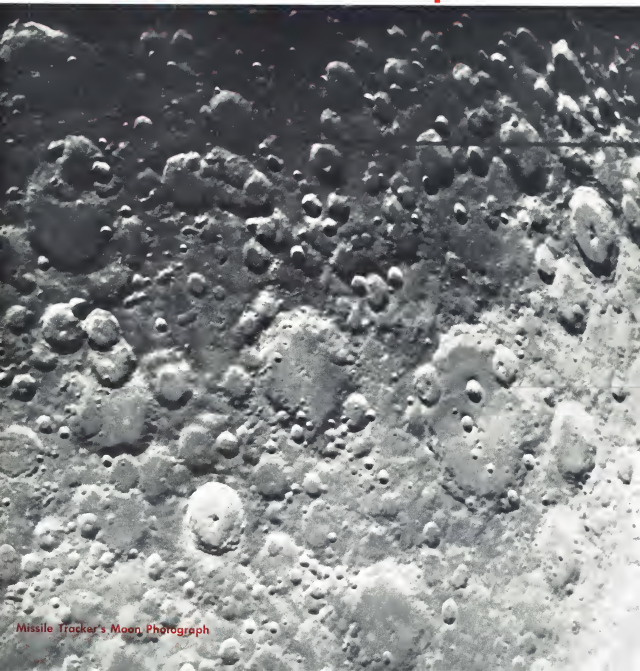


October 28, 1957 75 Cents

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

NATO Finishes
Fighter Trials
•
Tracking Camera
Follows ICBM



Missile Tracker's Moon Photograph

from Foote Bros.—



a guiding hand on the **BOMARC**

And now—the Boeing Bomarc BM-99—NEWEST WEAPON
FOR AMERICA'S DEFENSE

Foote Bros. has successfully designed, manufactured,
and completely qualified, control surface mechanisms
for the advanced long-range pilotless interceptor.

Leading manufacturers of airplanes, engines—both
jet and piston, missiles and accessories, know, from
long experience, that they can depend on
Foote Bros. for design, development and production of
highest quality mechanisms, gears, systems and components
to meet the most advanced requirements of current
and anticipated technology.

If your problem involves any phase of precision
power transmission, come to Foote Bros. first.

FOOTE BROS.

Boeing Power Transmission Through Foote Bros.

FOOTE BROS. GEAR AND MACHINE CORPORATION

607 South Western Boulevard, Chicago 6, Illinois

this trademark
stands for the
best industrial
gearing made



BUILDING
FOR THE

BIG BIG

FUEL CELLS
ONES!

Shown here are three "big ones" from Boeing—and they have this in
common: Massive and exacting fuel cells fabricated by Goodyear.

The KC-135 jet transport tanker is
being equipped with Goodyear-built
"stream drive" fuel cells as
auxiliary and backup systems,
which save weight by being these
compact cells with integral inlets
for support members.



The B-52D jet bomber employs
Goodyear fuel cells—the largest
yet cells being built into a B-52 jet
engine—designed to fit existing con-
struction and supply areas—delivered in
quantity from both our Akron and
Los Angeles facilities. Goodyear
delivers water cells for the aircraft
as well.

The F4U-106, Army's long-range
intercontinental jet, packs some of
its big needs in auxiliary cells—
the built by Goodyear.



Such assignments are awarded Goodyear Aviation Products
because its long experience in the fuel field has proved out
in record dependability of performance. For information
on how these pioneer skills and facilities can serve you, write:
Goodyear, Aviation Products Division, Akron 16, Ohio,
or Los Angeles 54, California.

Fuel Cell Engineering By



Where Research and Development, Field-To-Advance
America's Global Progress. In The Best For Air Power

(Continued from page 5)

Nov. 6-13—Third Annual Air-Gas Symposium, The Institute of Aeronautical Engineers Professional Group in Communications Systems Hotel Elton, N. Y.

Nov. 7-8—National Meeting, American Society of Mechanical Engineers, Institute of Aeronautical Sciences, Sheraton Hotel, Dallas, Texas.

Nov. 10-12—Symposium on Airframe Electronics, Regional Technical Conference, South of France Exposition Hotel, Antibes, France.

Nov. 11-13—Third ISG International Conference and Exhibit (Data Handling), Vienna, Austria, Hotel, Vienna, Austria.

Nov. 11-13-1977 International Air Safety Seminar, Flight Safety Foundation, Philadelphia, Calif. 13th Southern Week Safety Week, Denver, Nov. 14, for details visit ISG 800 Fourth Ave., N. Y. C.

Nov. 12-13—South Atlantic Electronic Conference, Park Motor Hotel, Dublin, Ireland sponsored by Aercon Int. (aerocon.com).

Nov. 13-14—Mid Atlantic Electronic Conference, Municipal Auditorium, Kansas City, Mo.

Nov. 13-15-1978 Annual Convention, National Aeronautics Association, Sheraton Hotel, Dallas.

Nov. 13-14—English National Physics Symposium, International Astrophysics, Glasgow.

Nov. 14-15—Third Nuclear Physics Air Group School, International Defense Physics Symposium, Los Alamos, N. M.

Nov. 14-15—Technical Conference, Inter-Allied to Transport, Air, Vienna, Austria.

Nov. 14-15—1978 Meeting, American Institute of Aeronautics and Astronautics, New Orleans, Louisiana, Sheraton Hotel, Dallas.

Nov. 14-15—1978 Meeting, American Institute of Aeronautics and Astronautics, New Orleans, Louisiana, Sheraton Hotel, Dallas.

Nov. 14-15-1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.

Nov. 14-15—1978, Eastern Joint Computer Conference and Exhibit, Sheraton Hotel, Washington, D. C.



Craig Helicopter-Hut (13' long) and 43'x50' (10' long) being transported by helicopter

SOMETHING NEW IN THE AIR...

New, longer, roomier Craig Helicopter-Huts® pack more payload than ever!

How much room does a communication system need? The answer is, of course, that's why CRAIG now manufactures the lightweight, non-transparent Helicopter-Hut in varying lengths from 70' to 134' (inside dimensions), with capacities up to 453 cubic feet.

They meet more room needs, larger payloads, and are free of all transparent material. And with its many room sizes and capacities to choose from, these versatile modular "Hut" systems take your communications to virtually any radio, microwave or communication system requirement.

Delicate electronic components and systems are now fully protected against shock, vibration, and extreme environmental conditions. Add a host of other delivery advantages.

Features:

- Light weight — 160-1200 pounds, transportable by air
- Payload — up to 6000 pounds
- Sealed design — 0.25 in.
- Airborne use — based in polyethylene foam core for maximum strength, maximum weight
- Equipment mounting — based in foam walls and ceiling
- Inside dimensions — from 70' x 10' x 10' to 134' x 70' x 71 1/2'
- Field and Laboratory Tested
- Official military communication system communications operations for worldwide use
- Special operations — many doors for truck loading, quickly accessible — daily for service

Special lifting device makes truck loading simple and easy. Helicopter-Hut also transportable by air — by C-119 or larger cargo aircraft.

For complete information, write CRAIG today.

Craig SYSTEMS, INC. Dept. M-1, Denver, Miss. Tel. 813-464-5275

WESTERN DIVISION: 6511 West Manchester Avenue, Los Angeles, 45, California 90048

OTHER CRAIG PRODUCTS: . . . transportable and mobile electronic systems, radars, radars, etc., which control aircraft, missile launchers, aircraft carriers, extreme heavy and more



communication is a sometime thing

Lips encouraged to voice new theories helped make possible modern rocket power. Yet—for the sake of our nation's safety—our lips must remain sealed to our enemies.

RMI has long been known for its "open test shut" communication—for its encouragement of creative discussion not only within RMI but also with others who are working to advance America's cause . . . and for its constant vigil to protect America's secrets. For over a decade and a half, RMI engineers and scientists have been cooperating wholeheartedly with our nation's security program as they blaze new trails in developing and producing today's . . . and tomorrow's . . . powerplants.

Engineers, Scientists—Perhaps you, too, can work with America's Air rocket family. You'll find the problems challenging, the rewards great.

Power for Progress

REACTION MOTORS, INC.

BERVILLE, NEW JERSEY

409

A MEMBER OF THE CRAIG TEAM

ENTER THIS CONTEST ... 90 CASH PRIZES!



CONTEST RULES

1. Tell us 25 words or less: Why I prefer Albanene tracing paper!
2. Send all entries to K&E Albanene Contest, Box 160, New York 46, N.Y. 10045 as soon as you wish. There is nothing to pay.
3. Entries must be handwritten and later than August 31st, 1967.
4. Entries become the property of Kuffel & Esser Co. when sent for evaluation.
5. The winners of the paper to find.
6. Winners will be notified by mail. A complete list of winners will be sent upon request. Winning requests to be accompanied by return, self-addressed envelope.
7. Contest is open to all residents of unincorporated United States, all non-Americans, and their business location, or Kuffel & Esser Co. or its subsidiaries and divisions, its advertising agency and branch of this contest.
8. Allow not applicable in countries of those states where there are prohibiting laws.

Why I prefer ALBANENE® Tracing Paper...

- First prize \$1,500
Second prize \$1,000
Third prize \$ 500
plus 87 prizes of \$25 each!

In 25 words or less, tell us why you prefer K&E Albanene® tracing paper. Your reasons may win one of these 90 prizes (it's K&E's 90th anniversary).

Here's a hint: Albanene is made from 100% rag stock for exceptional tear strength. It is permanently transparent with an insert center. Draftsmen like it because of its easy drawing quality... reproduction men for its high transparency and permanence. Everybody likes it because "what you

pay for stays in the paper." That's why Albanene is the best seller among all tracing papers.

Get contest aids from your K&E dealer! Information booklets, extra contest entry blanks, samples of Albanene, too, if you need them. You can order as often as you please.

Or use a plain sheet of paper if someone's already snatched the blank below. Give your name, address, and firm name, twenty-five words or less telling why you prefer Albanene tracing paper, and mail to K&E Albanene Contest, Box 160, New York 46, N.Y. before midnight, November 30, 1967.



KUFFEL & ESSER CO.
New York, New York 10045 • Chicago, Illinois 60646
St. Louis, Dallas, San Francisco, Los Angeles, Seattle
Branches in principal cities

HUSTLES AWAY HEAT FOR CONVAIR'S HUSTLER



Harrison Hydraulic Oil Coolers Selected for America's First Supersonic Bomber!

Harrison's on the Hustler . . . and temperature's the target! Convair's new F-106 bomber flies faster than sound at altitudes above 50,000 feet, and Harrison heat exchangers are on the job ensuring dependable performance.

You'll find lightweight, heavy-duty Harrison coolers on all types of the most modern aircraft. That's because Harrison's vast experience and research in the heat-control field ensure complete dependability . . . peak performance efficiency under the most severe operating conditions. So remember, if you have a cooling problem, look to Harrison for the answer.

TEMPERATURES MADE TO ORDER
HARRISON



HARRISON RADIATOR DIVISION • GENERAL MOTORS CORPORATION • LOCKPORT, N.Y.

K & E Albanene Contest, Box 160, New York 46, N. Y.

Here's why I prefer Albanene Tracing Paper.

Name _____ City _____ State _____
Street _____ Firm Name _____



The Boeing 707 Stratoliner—America's first jet transport—uses strong, lightweight *draftless forgings* by Kaiser Aluminum. Reason: A well balanced combination of engineering skill, forging know-how and a broad range of modern equipment—available at our Erie Plant.



Contact the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., District Sales Office, Pullman Building, Chicago 11, Illinois.



The Bell H-40

*Newest Helicopter on the Line
and the Army Has It!*



MAJOR GENERAL
HAMILTON A. HOWE
Director of Army Aviation

First new helicopter designed around a turbine engine—first ever built expressly for battle service, the Bell H-40 is the Army's own, designed and built to Army needs and specifications.

Low in silhouette, capable and rugged, the H-40 meets the Army's demand for easy maintenance in the field—economical operation, in a wide range of tasks—greater payload and exceptional handling ease.

This new super-powered helicopter is a tribute to the foresight of the men of Army Aviation... and their desire to keep their service "Above the Best." Through their efforts and design supervision, utilizing previous knowledge of Army needs, the Army got the best... the Bell H-40.

Watch
"NEWSWEEK" on TV...
consult your
local paper for
time and station.



SUBSIDIARY OF BELL AIRCRAFT CORPORATION • FORT WORTH, TEXAS



Good Service is Good Business

The importance of service is perhaps better understood by airline operators than by any other group of businessmen. The phenomenal growth of the airline industry itself is based on a dynamic program of constantly striving for better and ever better service standards.

We, of the Scintilla Division of Bendix*, have over the years made every effort to aid the airlines in accomplishing this worthwhile achievement.

Service to us means producing the finest and most modern ignition equipment that creative engineering and manufacturing skill can achieve, and, of equal importance, service means backing this equipment with a complete and efficient organization of trained service specialists whose every effort is given to insure that the customer receives full benefit of the quality and performance built into the equipment. Our extensive service organization has spearheaded in ignition equipment for over thirty years.

Airlines specifying Bendix jet ignition equipment have the definite assurance that jet service will in every respect match the excellent service we have given on piston engine equipment that has made Bendix—The Most Trained Name In Ignition.

*Trade Name

SCINTILLA DIVISION OF BENDIX AVIATION CORP., SEENL, N. Y.



Bendix produces complete ignition systems for jet engines. Bendix field service is the most complete in the industry.

Export Sales and Service

Scintilla International Division, 200 East 42nd St., New York 17, N. Y.

SALES OFFICES

151 E. Pennsylvania Ave., Bendix Corp. • Phoenix Building, 1020 South Ave., Detroit 26, Mich. • 1st Carter Lane, London, N. Y. • 200 North Port Washington St., Milwaukee 2, Wis. • Fabian Building, 102 St. Bernard St., Dayton 2, Ohio • 200 Second St., Dallas 12, Texas • 300 Mid Ave., South, Seattle 5, Wash. • 1000 7th St., St. Louis 8, Mo. • 1000 7th St., St. Louis 8, Mo.



Enjay Butyl—today's super-rubber improves pipeline protection...cuts costs!

Pneflex® Tape Coating, revolutionary new pipeline wrapping developed by Pneflex, Inc., combines the outstanding protective properties of Enjay Butyl Rubber with the identification properties of a color-bearing plastic film to which the Butyl is laminated. Applied over an Enjay Butyl based primer and forming a permanent bond to the metal, the tape protects absolutely against moisture migration or penetration; exceptional resistance to shock impact, excellent dielectric properties, and outstanding resistance to normal and unusual corrosive conditions. This self-applied wrapping is safer and cheaper to apply by hand or machine than hot coatings and requires fewer personnel.

This is still another in the steadily growing number of products developed with Enjay Butyl Rubber. Contact the Enjay Company for complete information about this truly wonder rubber...where it can help you! Complete inventory facilities, fully staffed by trained technicians, are at your service.



Pioneer in Petrochemicals

ENJAY COMPANY, INC., 25 West 52nd Street, New York 25, N. Y.

Also: Boston • Chicago • Detroit • Los Angeles • New Orleans • Tulsa



Enjay Butyl is the super-durable rubber with outstanding resistance to aging • abrasion • tear • shipping • stacking • water and acids • alkalis • gases • heat • cold • sunlight • corrosion.

Answers to the Toughest Problems
in Jet Aircraft Cooling...

LIGHTWEIGHT...THINWALL

STEWART-WARNER HEAT EXCHANGERS

Stewart-Warner's unexcelled experience can be used to meet your heat transfer needs!



B-57 and similar bombers are designed for司徒华 refrigeration system used on Boeing B-52



Air Force Model F4U—designed for the Stewart-Warner refrigeration system used in Chance Vought F4U "Cobra"



C-130 Hercules—designed for Lockheed C-130 Hercules



American Model F-100—designed for North American's F-100 "Super Sabre"

The South Wind Division of Stewart-Warner pioneered the development of heat exchange equipment for heating modern aircraft. Now South Wind is the leading producer of heat exchangers for cooling. Lightweight thinwall units in both stainless steel and aluminum—either air-to-air, air-to-liquid, or air-to-exhausting-liquid—are being designed and fabricated for a wide range of new and important uses. If you have a heat transfer problem, South Wind engineers can help you solve it. No obligation. Write to South Wind Division, Stewart-Warner Corporation, Indianapolis 7, Indiana.



South Wind

A DIVISION OF
STEWART-WARNER CORPORATION



this sealing nut
for integral tanks
has been
**PROVED FOR
5 YEARS**



Before Attachment

but retains its shell, but remains in contact with structure.



After Attachment

Installation forces bearing surface of sealed nut to contact structure, forced by rotating single point sealing.

Nutt-Shel has designed many new products to solve complex problems, but none has received greater acceptance than this self-sealing dome nut. For integral fuel tanks, and other applications where positive sealing is required, this design has been proving its reliability for five years.

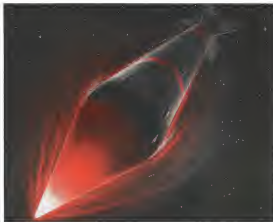
FEATURES

Conforms to all applicable government specifications, **Flange 622** in all diameters. Two configurations and light weight. Nutt-Shel membranes in light weight steel, zinc thread sizes. Available: stainless steel ring, stainless steel shells.



REPRESENTATIVES

EAST—BURELL, NEIDHART & BODEN, Inc., 1000 N. 10th St., Indianapolis, Ind. 46202. SOUTHWEST—BURELL, NEIDHART & BODEN, Inc., 1000 N. 10th St., Phoenix, Ariz. 85001. SOUTHWEST—BURELL, NEIDHART & BODEN, Inc., 1000 N. 10th St., Phoenix, Ariz. 85001. SOUTHWEST—BURELL, NEIDHART & BODEN, Inc., 1000 N. 10th St., Phoenix, Ariz. 85001. SOUTHWEST—BURELL, NEIDHART & BODEN, Inc., 1000 N. 10th St., Phoenix, Ariz. 85001.



Heat-shrink tubing (top) can be EBF-T, an anisotropic material used to adhere electrical components and test leads. EBF film base laminates of Teflon®-adhesive laminates of these heat-shrink tapes are also available in reinforced sheets.

LATEST HIGH-HEAT INSULATION SYSTEMS NEED CDF GLASS-BASE LAMINATES AND TAPES

What's available range offers Teflon, epoxy, silicone, micro products for dimensional stability under corrosive heat.

As components and equipment grow smaller, and heat becomes more difficult to dissipate, CDF high-heat electrical insulation becomes increasingly important to electronic design. For nowhere else can such a wide range of quality insulations be found under one roof as at CDF.

FOR HIGH-HEAT PRINTED CIRCUITRY. CDF glass-base metal clad laminates of Teflon® and epoxy exhibit best dimensional stability and current-carrying capacity. Constant operating temperatures of 300°F — soldering temperatures to 500°F — are routinely met by these specialized CDF Diecto® laminates.

HIGH-HEAT FLEXIBLE INSULATIONS. CDF offers a wide choice of insulating tapes made of Teflon, silicone varnish, silicone rubber, and Macbond®, with glass cloth support. CDF tapes may be used either by hand

wrapping or on automatic winding machines. Unsupplied Teflon is also available to meet MIL-STD 304.

TEFLON SPAGHETTI TUBING AND OTHER SPECIALTIES. Part of CDF's vast fabrication facilities is devoted to the production of custom parts from Teflon — spaghetti tubing, rods, sheets, and insulated parts to rigid specifications.

NEW — reworkable Teflon, bondable to itself and to other materials with commercial adhesives.

SEE SWEET'S Product Design File, Electronics Buyer's Guide, and other directories for the name and phone number of your CDF sales engineer. Then send your print or your problem, and we'll return specific technical data and test samples.

Trademark of DuPont International Chemicals Corp.



CONTINENTAL-DIAMOND FIBRE
A SUBSIDIARY OF THE *Woolf* COMPANY • NEWARK, NJ, 07102

now available from Trent—

Titanium Tubing

For processing from carrying fluids of an extremely corrosive nature — look to Contour Trentweld titanium tubing for reliable service.

This titanium tubing is completely uniform throughout any cross-section. The weld zone is free from bulging weld bead because Trent's exclusive process — performed with the weld area at the bottom — forces the molten weld metal into the shape of the tubing.

And, with titanium, you get the unique advantages of a tubing that's strong as steel but 44% lighter... virtually immune to a broad spectrum of corrosive workloads... safely free from stress-corrosion cracking.

So, next time you need a strong, light, extremely corrosion-resistant tubing — by Contour Trentweld titanium tubing. And remember, it's made by Trent — tube roll specialists.



**Stainless and High Alloy
Welded Tubing**

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TOWN, WISCONSIN (Subsidiary of Crucible Steel Company of America)

Intelligence Without Leadership

Intelligence on the capability and intentions of any potential enemy is a vital ingredient in the formula for survival in a troubled world. In the past, there has been a good deal of mutual criticism of the U.S. effort in the military and political intelligence field, but there has been major improvement on this score during the past decade. In fact, it is apparent that our intelligence apparatus is now functioning on a national leadership far more robust, particularly on the spectacular scientific side of the Soviet Union, than it can depict.

History is full of examples of disaster that overtake nations whose top leadership refuses to act on the basis of good military intelligence. It is pertinent to recall the criticism of Charles A. Lindbergh when he returned from his 1916-17 visit to Nazi Germany.

Lindbergh, then the best known aviator in the world, went to Germany at the request of the U.S. Army Air Corps on the theory that the late Herman Goering's pride and vanity would induce him to show Lindbergh his more of German aerial developments than in ordinary visits. The former great of comets and Landings not only saw the new German fighter and bomber designs and the new factories in which they were being mass produced but also was permitted to actually fly such planes as the Me 109 fighter and Ju-88 bomber.

When Lindbergh returned to the U.S. and Britain, top political leaders were deaf to his warnings of the impending effect of German aerospace. Only a few military aviators in both countries heeded his warning and did what they could to prepare for the inevitable storm. I remember listening to the late Gen. "Bip" Arnold tell a group of reporters in San Francisco not long before he died the story of how he talked with Lindbergh on the backyard boulevard at West Point to get his first report on German aerospace. Without that data, Gen. Arnold told me, American aerospace would have been hopelessly unprepared for facing the Luftwaffe in the air later. Yet his reporting does little. Lindbergh was personally vilified by political leaders who lacked the courage to face the hard news he dispassionately presented. Britain went down the road to the appeasement of Munich and the bloody disaster of Norway, France, Greece and Africa before the advent of our serious leadership was able to turn its tide.

The U.S. had double intelligence warnings on the actual attack on Pearl Harbor but its leadership failed to act in either case. The first intelligence came from the Navy's cracking the Japanese secret code and intercepting the radio messages that launched the Japanese carrier attack against Pearl Harbor. For reasons not yet made historically clear, these messages were never passed on to the U.S. military command in the Pacific whose forces were the Japanese target. Even after the Japanese planes were launched, they were detected by Air Corps radar in time to alert the air defenses of Hawaii. Here the chain of leadership broke down at its first echelon when a second lieutenant dismissed the radar reports and left Hawaii to take the first Japanese blow undefended.

During World War II, the Axis had its share of top leaders who were unable to absorb intelligence that did not fit their preconceived ideas. Adolf Hitler had superb intelligence warning of the two colossal Allied offensives—first in North Africa and later in France. But

his own preconceived ideas of military strategy prevented him from allowing his field commanders to act on this intelligence. By the time he released them to make proper decisions of their forces, the offensive armies were successfully subdued.

We are now well along into a period where totally genuine effort of all types has been producing a steady flow of solid technical information on Soviet progress in aircraft, missiles and space vehicles for a national leadership that appears to be susceptible of digesting this information or acting on the problems it raises.

First and clear that the Soviets were on the way to the revolution in the use of gas turbines, vapor rockets, rockets and outer space came in 1948 when USAF assigned the first western picture of a MIG 15 supersonic fighter in flight. This photo was promptly denounced by the highest Defense Department authorities including the late James Forrestal, then Defense Secretary, as a fake produced by USAF for propaganda purposes.

When USAF and Navy pilots began fighting streams of MIG 15s over Korea later against heavy odds, authenticity of this photo was proved in blood.

Since the Korean war, there has been a steady rise from all types of sources on the size, scope and rate of progress of the vast Soviet technological drive to develop new solid weapons. After the first Soviet atomic explosion in 1949, there was public display of long range jet bombers and supersonic fighters in the air shows of 1955, the development of giant helicopters and jet transports, by 1955, the first stages of an intercontinental range ballistic missile, the next year, the ICBM program reached test firing stage, and, finally in 1957, the Sputnik satellite took to orbiting the earth propelled into space by the ICBM propulsion system.

In the face of this accelerating stream of evidence on the growth of Soviet military strength from new technological weapons, our own national leadership has been conducting a policy aimed at reducing our own aerospace strength in being, artificial, retarding the pace of our military technological development and thus discouraging the best efforts of both military and scientific leaders concerned with this vital program.

President Eisenhower's most recent attempt to depict the achievement of the Soviet Sputnik satellite, his insistence that neither he nor his cabinet and staff were and has continued to resist to tell the American public facts on the Soviet missile program that scientific intelligence has been warning to him for two years (AW Oct. 21, p. 26) are not new phenomena.

As long ago as 1954, the President's Defense Secretary Charles E. Wilson was "push-poking" new Soviet aircraft as "hand-built prototypes," even though they had publically an innovation of 45 to 60 years. It was Mr. Wilson who, in the spring of 1955, tried vainly to conceal from the American people the types and quantities of new Soviet fighters and bombers that flew publicly over Moscow in view of millions of Russians and foreign diplomats.

This country cannot continue to survive as free world's leader in fact of the Communist challenge with our leadership that has the integrity and courage to face up to the grim facts provided by our intelligence system.

—Robert Hertz

ENVIRONMENTAL
TESTING & ANALYSIS

to furnish the performance of your products under actual service conditions

The personnel and facilities of Bell Aircraft Corporation's Research Division are now available to you in testing and analyzing the performance of materials, components, systems and packaging under environmental conditions duplicating those which will be encountered in use. Years of operational behavior can frequently be simulated in hours in the laboratory.

Extensive and diversified experience in such fields as automation, electronics, nuclear physics, servo systems, guided missiles, rocketry and aircraft commonly qualifies Bell engineers to handle your most exacting assignments quickly and competently. Qualified Product Test (QPT) testing and Military Certification of tests are available. All equipment used complies with the requirements of MIL-E-5272A.

HI-CAPACITY CENTRIFUGE Capable of holding 200-500 lb. of objects subjected to 100 g's constant acceleration.

AUTOMATIC CHAMBER Capable of withstanding 1000 psi up to 100,000 feet. Temperature 0 to -100° F. to +200° F.; Humidity, to 100%. Physical size 18" x 30" x 30".

SALT SPRAY TEST CHAMBER Capable of temperatures from 50° F. to 150° F.; Humidity to 100%. Spray rate capacity up to 100 cubic feet.

REFLECTION CHAMBER Capable of temperatures from 10° F. to 150° F.; Altitudes to 50,000 feet. Capacity 5 cu. ft.

ACCELERATION • IMPACT SHOCK • ACCELERATION
VIBRATION • TEMPERATURE • HUMIDITY
HUMIDITY • SAND AND DUST • EXPLOSION
FATIGUE • SALT SPRAY • BURSTING • RAIN

Additional information and a copy of Bell's R&D "Environmental Test & Analysis" can be obtained by contacting John Thompson, Research Div., Dept. 22, BELL AIRCRAFT CORPORATION, Two Office Glen View, Buffalo 3, N. Y.

BELL
Aircraft Corp.

Research Division
BUFFALO, N. Y.

they have been loosely used. Close tolerances on large forgings have been pioneered by Wyman-Gordon over the years. The degree of precision which is practical now becomes a question of economics.



Published 1999

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER 1, MASSACHUSETTS
HARVEY ILLINOIS • DETROIT, MICHIGAN

In the Front Office

Robert M. Mager, executive vice president and a director, Winnebago Industries, Inc., Chgo., Ill.

Richard C. Diehl, vice president operations, Universal Cycles Steel Corp., Indianapolis, Pa.

11 L. Thackerell, Jr., vice president
Grand Central Rocket Co. Redford, Calif.
The Stanley Wingers, awarded very poor

Edel McCullough
for Tom Bruce Cook
Edel Cook, John M. Steele (USA), et al.

United States, 1990. *Journal of Accounting and Finance*, 31(1), 1-11. (reprinted in the next paragraph.) European operations (Pepsi). *Republic America Corp.*, Danburyville, N. Y.

Gen. James H. Doolittle, Maj. Gen. V. best friend, and Adm. William D. (USN, air) received awards for pioneering work in experimental test flying at the first annual awards banquet of The Society of Experimental Test Pilots. An award also was presented in absentia to Howard Hughes.

Frank C. Deacon, director, growth and development, and John D.H. McKinney, principal engineer research and development section, Clari Dynamics, division of Clari Corp., San Gabriel, Calif.

F.J. O'Brien, manager, AdResearch Associates, Inc., a subsidiary of American Research, Inc., of Los Angeles, Calif. **Harmon Holmquist** succeeds F.J. O'Brien as manager of the AdResearch Western Service, Cincinnati.

James W. Flower, management staff officer, Industrial Sales Department, Libbey-Owens-Ford Glass Co., Toledo, Ohio.

• Both the Corvair Wanda and deluxe versions (AW Oct. 21, p. 27) and Lockheed's Fast Figs utilize monocoque skins (AW Oct. 18, p. 16). To be made the companies of Air Research Development Co. and Lockheed Missile Agency headed by Maj. Gen. Samuel A. Schriener in Los Angeles. These are the first two USAF projects in the agency that will have no connection with the Boeing-Westinghouse Corp., which has had technical supervision on the Corvair Atlas, Douglas Thor and Martin Thor ballistic missile programs.

* At least three aerospace scientists have volunteered to ride in a ballistic test vehicle to obtain personal subjective reactions to space flight. Six months of the offer indicates the degree of faith in current recovery systems, helps establish a bench mark to measure success in solving the re-entry problem.

► Winner in WS 110A chemical bomber competition between North American Aviation Inc. and Boeing Airplane Co. is scheduled to be announced in December. An F-105 team is now at Boeing in the context of final evaluation stage.

▲ **Posicast Converter Affine** and future Martin Tatum intercontinental ballistic missile test stands cost in the neighborhood of \$2 million each to five. Just 18 years ago, cost estimates of about \$1 million per ICBM test stand were dominated by Arac Converter affairs in sidetracks.

► Watch for a British attempt to push the official absolute speed record to 1,500 mph with an updated version of the Falcater F2.2 research plane. Peter Tuma, test pilot who set the present 1,332 mph record in the Delta, would pilot the updated version.

Among the "nightmare" satellites was a proposal for a three-stage rocket which some experts feel would have put a U.S. vehicle in orbit as early as February, 1955. Proposal called for three standard rocket vehicles—a Minuteman Viking, a second-stage Atomjet Aresoler and a third-stage Deacon solid-propellant rocket.

* Cockpit temperature in Cessna F160 has been reduced to 65.9°C (150°F) using electric air heating in forward side panels made of stretched polyurethane (Sennar 61) with electrically conductive Sennarcon for inside panel and vinyl interface. Cockpit temperature in Cessna F160 was hot on air heating has been as high as 130°F.

▲Mississippi-Hawseville's Monrovia, Calif., facility is putting work on ASDC deep-to-medium water vehicle. Much is essentially a solid propellant rocket-launched torpedo that is fired through the air for a considerable range, then enters water where electric-powered torpedo is directed by homing device to the target.

* *Rodrigues*, Co.'s SKD-8.1 engine has been successfully test flown with rocket power for three to four minutes at speeds of about 480 kt. at Naval Air Missile Test Center, Point Mugu, Calif. Tests followed numerous unpowered drops from McDonnell F-4H. Army will launch its version of the engine, the RP-76, from loaded F-85, later from Buhnerhue's RP-77DL, design.

► Lockheed F-104, originally scheduled to become operational with the Air Defense Command in Hamilton AFB, Calif., but April, are now scheduled to be phased in at the end of next month. Aircraft has had stability and various other problems - both reportedly have been cured.

*Defense Department officials on the military requirements put into the three-ton helicopter wanted by the services (AW Sept 30, p 23) will set performance requirements, that its performance will be no better than the heavy-duty helicopter wanted by the International Air Transport Association.

►Texaco's rocket-powered target drone has been troubled by pitchup at the moment of separation from the mother plane.



The engineering staff of Waukesha Motor Company and Hamblett-Hoppe Corporation, cooperating with the CAW, designed and built a Class II prototype using Union Carbide Silroses as the insulating resin. Silroses stand up under temperatures and loads that hunk down other insulating materials. The result is a unit no larger than those

This is another example of how the United Campaign Sclerosis Man has helped solve an "impossible" manhood problem. Sclerosis permits smaller units for equal jobs...or greater capacity for added loads. To obtain more information, write for "Class II Inclusion with United Campaign Sclerosis." Address Dept. AW-16, Sclerosis Division, United Cerebral Corporation, 30 East 52nd Street, New York 17, N. Y.



UNION CARBIDE SILICONES

—Wingless, it will



TECHNICIAN adjusts the model's angle of yaw with the sector angle control system in the tunnel opening console.



PRESSURE tubes inside one of the engine air inlets are checked for leaks and response prior to a test.



FINAL adjustment is made to model's instrumentation. Prefabricated test section walls in the Convent high-speed tunnel are visible.

T-38 Model Shows Low Drag Wing Fairing

Northrop T-38 supersonic basic trainer, shown during wind tunnel test at the Cornell Aeronautical Laboratory, has been assembled and considerable time was used in testing the optimum shape of the fairing for the wing root.

The fairing leads to compare the flow over the selected portion of the wing trailing edge, increasing the static pressure there and reducing drag. Most wing pressure drag originates on the internal sections and fairing conditions around the wing root are important.

The wing is a sweptback, all-moving type of control surface. The wing is cam, thin varying from 55% thickness at the root to 35% at the tip.

Lateral control is effected by small-span, long-chord ailerons located well inboard.

Utilizes Fung Footrests
The T-38 utilizes many features of the Fung, a Northrop experimental fighter design. Speed and ground clearances of the T-38 would make its

conversion to a light-weight fighter a relatively simple matter and this is one of Northrop's selling points.

Changes to the fighter role would be accomplished by removing the rear seat and adding fuel tanks or electronic gear depending on the type of mission to be performed. Accidents will be a part of the trainer equipment and there is space in the tractor for basic electronic navigation and weapons directing equipment. A low-as take-off weight can also be handled by the basic trainer vehicle.

Tests Purpose

Main purpose of these particular tests was to determine the aircraft's stability characteristics from about Mach 3.5 to Mach 4.5. Current portions of the program being conducted at Cornell involve models which are structurally similar to the aircraft to investigate its aerodynamic characteristics.

Model shown here is equipped with an adjustable sting which sets it at more fixed pitch angle with reference to the tunnel air stream. The yaw angle of the model can then be varied into maneuvers while the tunnel is running. The trailing edge outlines the aircraft's tendency to pitch, roll and yaw during maneuvers which combine yawing and pitching motions.

The T-38 will be powered by two small turbojets mounted in the fuselage of the configuration so that they can be serviced and removed with a minimum of aircraft disassembly. The basic model has about 2 deg. of adjusted roll in set low about at the place of the



TECHNICIANS check the sector condition of the model before a test run begins.

Holaday Speech Describes Shift To Solid Propellants for Missiles

Bohannon City, Okla.—Large open roads exist for solid propellant in new missiles, William M. Holaday, Special Assistant to the Secretary of Defense for Guided Missiles, said in a speech delivered for him here last week. The speech, delivered by Holaday to Brig. Gen. Lester W. Smith at the opening of Thiokol's Chemical Corp.'s new solid propellant plant here, stated officials want AMRAAM, which has no ported motor about solid fuels (ENR 7 p. 70).

While in the past, most big rockets have been liquid fueled, following General Dynamics' lead, the V-2, the Holaday speech said, the specific major advantage of liquids over solids has narrowed, while the solids have retained other advantages. This includes ease of simple construction and need for fuel tanks, lines, valves, etc.—they avoid problems stemming from use of liquid oxygen which requires special handling and insulating equipment because of its low temperature and cannot be stored in the same as rocket fuel for long. Liquid rockets also require a much longer countdown before firing to allow for fueling and checkout while solids can have short countdowns and be kept ready for firing over prolonged periods and have a reputation for reliability.

Regarding growth in the solid propellant rocket field it was pointed out there are now over a dozen companies in the business. Despite rapid growth

in performance and variety of applications for solid rockets, the Holaday speech said people in the industry support that they have not yet reached a state of performance limit.

A growing proportion of development in total expense for a missile produced no useful increases demands that even advantage be taken of existing missile technology and that missiles should be designed for maximum flexibility of operational assignment so that costs can be reduced by making larger numbers of lower designs.

Nike Apco was developed for about 10% of total cost but it is now possible for development cost to actually exceed production cost of a missile. Holaday suggested that missile development is proceeding at maximum speed.

New Thiokol Plant

The speech was made at a ceremony opening Thiokol's plant, located 53 miles west. The one-story building was built for use as capable of handling an engine 12 ft in diameter and developing two million lb thrust.

For the casting of propellant grains are also capable of handling 12 ft in diameter. In Thiokol rockets, liquid rocket propellant tanks usually still in close metal case when fired.

It is chemically related to Thiokol's polyamide synthetic rubber Oxidizer's main component, perchlorate. Holaday said it is being studied but is not expected to appear except in

additives in the main fuel. Thiokol claims a reliability record of 97.5% for its solid propellant motors.

Firing Bay

Manufacturing, storage, testing and administrative facilities are scattered over an 11,000-acre site for solids. The big firing bay, called the largest bay erected there since the U.S., will stand two columns 10 ft apart with each 304-in. diameter. Small deflections in large thrust give high natural frequency for accuracy, according to Holaday.

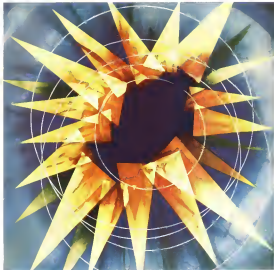
Electra Proposed For Anti-Sub Role

Washington—Economic incentives have lured the Navy to select a new submarine warfare aircraft. Simple configuration apparently had been favored initially, but some elements in the Bureau of Aeronautics now lean toward long lead ASDW design, and Lockheed is preparing a version of its Electra turboprop (AW Sept 16, p. 25).

Beyond the full impact of the current military common drive was 604, Curtiss-Dresser at General Dynamics Corp. had practically obtained the Navy's go-ahead for its ASW Model 74 supersonic proposal, but the contract has not yet been awarded.

Now, Lockheed Aircraft Corp. has proposed its Electra version of its upcoming Electra turboprop-powered transport for ASW service, American West has joined.

Contract design for its Model 74 ASW supersonic, as proposed to BuAer,



breaking the barriers with Utica Vacuum Metals

Today's challenge has in developing metals and alloys of tracking the thermal barrier.

The metals problem has already been partially solved by superalloys produced through Vacuum Melting. This process was developed by Utica, has yielded such major refractory alloys as Udimet 500—a strong, pure alloy containing untempered stress rupture life with superior high tensile strength as the 1000°F to 1900°F range. At 1000°F, Udimet 500 has a tensile strength of over 200,000 PSI. In addition to making new superalloys, Utica Metals Division of Kelsey Hayes upgraded existing alloys through Vacuum melting. Kelsey Hayes Co., Detroit 22, Michigan.

VACUUM MELTING provides these properties

- High temperature resistance
- Superior ductility
- Excellent oxidation resistance
- Precise alloy control
- Longer life in corrosive environments
- Better fatigue resistance
- Superior strength
- Superior impact resistance
- Superior creep properties

KELSEY-HAYES

Airline, Automotive and Agricultural Parts • Hand Tools for Industry and Home.
All KELSEY-HAYES products are made in the U.S. of American materials. Utica Metals Division of Kelsey Hayes Co., Detroit 22, Michigan. For more information, write to: Kelsey Hayes Co., Detroit 22, Michigan.



Supersonic Target Missile

Except for liquid rockets, Rockwell's Q-3, standard X-7, a supersonic vehicle used to test rocket engines. Rocket motors have been adapted to jets, using conventional fuels from X-7. Like the X-7, target vehicle has parachute for recovery. Missile, constructed to meet near miss, theoretical hit, is being developed at Lockheed's Van Nuys, Calif., plant.



FRESH
IMPETUS
FOR
PROGRESS

For Canadair...The Sky is NOT The Limit!

What we have learned in the air—we apply on the ground. See these snowmobile-type vehicles: they are a solution to an unique problem of transport over trackless terrain through snow, muskeg, sand or water, and were Canadair-developed and manufactured for the Canadian Armed Forces.

And Canadair's research and development division is ready to undertake other special jobs in many fields, such as: research, development problems, custom designs,

electronics, digital and analogue electronic computing, structural and mechanical testing—in all a service designed to offer fresh impetus for progress.

Inquiries are invited—write directly to Vice-President/Engineering, Head Office.



CANADAIR
LIMITED, MONTREAL, CANADA

• Research • Research and Development
• General Motors • General Engineering
A MEMBER OF GENERAL MOTORS CORPORATION

- Highlights these specific features:
 - Configuration incorporates high wing supporting three Wright Turbo-Comp radial engines. Center engine is higher than powerplants on either side so that propeller clear is full.
 - Floor is larger than Lockheed's P-3V. Cockpit accommodates pilot, copilot, navigator and controller (optional). It'll accommodate about five other crew members.
 - Frequent observation blister is located forward of the cockpit.
 - All of cockpit is a hinged loading door to forward hull compartment and acts as a standard side entrance during some of the early mission gear.
 - Complete gear includes electronic counter-measures equipment, radar, radio sensor and magnetic detector.
 - Canards, buffet and tanks are installed aft of the wing compartment.
- Space directly beneath hull top shell accommodates electrical gear. Also below the hull floor is space to avoid exposing equipment to constant sea water.
- The wings forward is long line. On aircraft 20, magnetic detector gear is installed in hull boats which extend aft of radar looking edge.

Varig Airlines Orders Two Caravelle Jets

New York—Two Sud Aviation Caravelle jet transports have been ordered by Varig Airlines of Brazil at a cost of \$1 million. Delivery of the first plane to Varig is scheduled for June, 1970. The order represents the first tangible result of Brazil's North and South America sales tour last spring with the bi-jet aircraft. Varig now uses the Caravelle as its main between New York and South America as an interim plane before delivery of Boeing 707s. The Caravelle fleet could serve Varig's coastal route.

The Varig Caravelles will seat 44 passengers in first class accommodations. Flight time between New York and Rio de Janeiro is expected to be 11 hours, with two stops en route.

Employment Lag

Windsor-based industry on pleasure dropped 24,800 in the first months from April to August, pollsters say. Bureau of Labor Statistics figures for August show:

Delaware: 10,000 reduced jobs from 40,000 to 30,000 in August. Figure for July was 40,000 (AW Sept. 30, p. 3). Rhode Island: 10,000 reduced from 30,000 to 20,000 in August. Figure for July was 30,000 (AW Sept. 30, p. 3).



Sidewinder's Scanner Shown

Sidewinder, outengaged in tests inside room in operational use with Sea and Seventh Fleet, is shown mounted under wing of Grumman F-14. Optics head (below) and sensor are visible. Sidewinder is produced by General Electric's Light Military Electronics Equipment Dept. and Philips Corp.

News Digest

Easton T-204 will not be built in East Germany under Russian license, East German sources report.

Seven-member Swiss Air Defense delegation conferred with Douglas Aircraft Co. officials on proposed purchase of A-10 Thunderbolt II bombers by Swiss Air Force Group, headed by Gen. Edmund Premaratne, chief of the Swiss Air Force, was part of a Swiss purchasing mission to visit U.S. aircraft manufacturing.

British Ministry of Supply Value was recently flown from Birmingham to Montreal and back, carrying under the Decca system between 10 deg. W and Canada; using European and Canadian Decca coverage for the remainder of the flight. Flight was made in part of North Atlantic route of the system. Tracking and ranging performance are now in operation. The tracking pattern being produced from two stations in Newfoundland, the ranging pattern being generated by synchronized transmitters from stations in Newfoundland and Scotland.

Production production of 10 Mergers.

III operations interceptors begin at Zhukov's St. Cloud facilities. Mergers proceed by Soviet Air Force and mid SEPR rocket test.

Russian government newspaper in article charged that the United States dispatched several squadrons of jet bombers to Turkey that are capable of delivering the atomic bomb. The article also stated that large numbers of U.S. troops were being moved in Turkey in preparation for an attack on Syria. Changes were made in support of the Soviet claim that the United States is planning an attack on Syria through Turkey. Both the United States and Turkey have emphatically denied the accusations.

Development aircraft for the Soviet 4 and 40 jet fighters, the Soviet G-AN-10, has been flying from Leningrad to Kharkov, establishing a new record of 5 hr 31 min 14.8 sec for the 1,000-kilometer course. The aircraft is a modification by the Volynskiy Avtomaticheskoye International, represents a speed of 525.4 mph. Soviet 4 went to Kharkov for the first of a series of tropical trials during which it tested, climb and landing performance, at various weights, will be conducted in tropical areas engaging up to 1000 and more.

Summer Atlantic Traffic Continues Gain

Tourist passengers total 369,000, accounting for most of record 21% June/September increase.

By Glenn Garbino

New York—Transatlantic traffic soared 499,000 passengers last summer over that scheduled North Atlantic flights, a 21% increase over the same June/September period of 1956.

After a slow beginning, the last peak season of the all-pan Am on the Atlantic rolled up a total of 369,000 tourist and 99,000 business passengers.

Possibly because of the bare crew of last fall, eastbound traffic for the first five months of the year fell far below the carriers' expectations. But things began to pick up in April, and during the summer peak months prospects for an excellent 1957 grew brighter. Once order was the carriers held strong through September.

Westbound Did Well

Westbound traffic, boosted by refugee and emergency law passengers, was the ahead of eastbound income during the early months of the year.

Next summer the harboring Benelux Britain will be going the Atlantic, and after that come the U.S., Alaska, and developments during the 1957 season will follow.

• New interest among tourist traffic for the first time was the Douglas DC-7C and the Lockheed Super Star Constellation.

• Two new lines, the premiere of first class and the reduced-cost 17-day ocean cross, were in operation for the first

time. How much new business the ocean line generated remained a moot question.

• Shift to the more class configuration continued during the summer. Flights with combined first class (including de luxe) and tourist accommodations increased 14%, while all first class flights decreased 25%, and all tourist flights were down 10%.

• Seats available during the first month period totaled 641,561, up 15% from 1956. Overall load factor, eastbound and westbound was about 71%.

Eastbound Dipped

January, eastbound traffic totaled 35,819 passengers, up only slightly from 35,410 in January, 1956. February and March were equally disappointing, April registered a gain of about 4,000 passengers, and eastbound traffic in May totaled 52,613 passengers (compared with 51,591 in May, 1956). The total was an

total traffic, in both directions for the first five months was 299,695, a gain of about 12% over 1956. But the westbound increase was about 30,000 passengers, while the eastbound total was up only about 14,000.

In April, tourist first class business accounted for almost 41% of the total June/September traffic. In 1957 tourist traffic increased about 24% over the 1956 summer total of 288,257 passengers, while the first class passenger total was up about 10% from 37,868 in 1956.

The transatlantic carrier operated 10,095 scheduled passenger flights during the 1957 season, up from 9,381 in the same five months of 1956. Flights split 5,661 eastbound, 4,434 westbound.

Most flights for the first time edged out all tourist flights with total of 5,160 mixed and 3,315 all-tourist operations during the summer. First class flights totaled 1,167. In January 1956, total was 3,797 mixed, 3,391 tourist and 1,869 all first class flights.

Of the total, all-tourist flights: 384,700 were tourist and 399,100 were first class. Eastbound seats, totaled 320,500 with a load factor of 64%. Westbound, seats totaled 373,300 and load factor was 77%. Eastbound loads were 205,000 eastbound and 213,500 westbound.

Generally, reported results of the carriers for year seem to depend on the view that airline held when the conference after war ended in 1946. By International Air Transport Association, and which were still being debated earlier this month at IATA's biennial conference in Miami (AW, Oct. 2, p. 39). Trans World Airlines for example, in original program of the plan, has toward the line "all in all points" helpful to business. At 7,288 roundtrip 17-day ocean line fares were sold by the airline between Oct. 15 to last week and Aug. 31, 1957.

Survey Needed

On the other hand, some other carriers agree with Trans Canada Air Lines vice president, W. Gordon Wood, who says that the "gap" created by ICA with the carriers for first transatlantic travel has shown that the time is too short to provide the accurate answer to indicate new level.

Until somebody makes a survey, it will be difficult to determine just how much of the new business would have developed without the law. One air official suggested that business travelers might be using of one short legs to get the lower rates, but that may not necessarily reflect reality.

In any event, the confusion that is an obvious consequence pending agreement among the IATA members on some kind of dual class rate.

TWA began for June, July and August show increases of 7.8%, 9.9% and 11.1% in transatlantic passenger traffic respectively for those months. Total was 23,436 for June, 31,663 for July and 30,998 for August. First class business in June was up 4.2%

North Atlantic Scheduled Passengers June/Sept. 1957

| | EASTBOUND | | | WESTBOUND | | |
|--------|-----------|----------|---------|-----------|----------|---------|
| | Flights | Tourists | Total | Flights | Tourists | Total |
| June | 18,480 | 42,580 | 61,060 | 12,700 | 42,580 | 55,280 |
| July | 11,300 | 42,580 | 53,880 | 9,400 | 41,000 | 50,400 |
| August | 9,400 | 32,800 | 42,200 | 12,400 | 41,000 | 53,400 |
| First | 18,200 | 26,800 | 45,000 | 10,400 | 34,000 | 44,400 |
| Total | 49,180 | 160,400 | 209,580 | 44,500 | 157,580 | 202,080 |

from 1956, but increased 28.2% in July and 24.8% in August over three months of 1956.

Though a Port of New York Authority survey of transatlantic air travel showed relatively little use of the passenger plane, the airline officials will all do their "TWA" for example, reports 510 million in passenger seats over the plan went into effect in August, 1954.

In 1956, according to Trans World, it sold about \$4 million and in the first

five months of this year sold about \$11 million.

Trans World's big boost in the North Atlantic last summer was extra service of its "Jetstream" long-range 364s.

The American carried about 97,800 passengers during the four months, up from 50,780 in 1956. The carrier operated 574 mixed flights, 1,066 tourist flights and 714 first class flights, compared to 764 mixed, 1,134 tourist, and 534 first class flights in the same months of 1956. About 15% of Pan American's transatlantic passengers are passengers, the other 85% are tourists.

Other Results

Some other individual results of the 1957 summer season:

• Air France carried 22,880 passengers, 10,980 of them eastbound and 12,900 westbound. Increases over 1956 were 25.6% and 25.4% respectively. Last month was September, with 3,215 eastbound and 4,015 westbound passengers for a total of 7,230. The French carrier in Aug. 5 introduced its 544 Constellation, calling it the "Super Starliner," and using it as both de luxe "Calédoniennaise" and mixed flights. Air France also offered new through service this summer between the United States, Europe and the Near East. The carrier's new program of 544 Constellation is the largest of its traffic income by "the enormous contribution of the transatlantic."

• British Overseas Airways Corp's traffic totaled 40,315 passengers up from 24,449 in August 1956. First class passengers totaled 10,380, down slightly from 10,857 in 1956, but tourist passengers increased from 17,662 to 29,937. Monthly, BOAC's 1957 figures were June 10,607, July 14,476, August, 9,909 and September, 9,622.

De Luxe Flights Full

The airline, all de luxe "Mauritius" Starliner flights, currently continue in one, high load factors, BOAC reports. Last summer BOAC was offering DC-7C service to Europe from the East Coast as well as from San Francisco, Chicago and Detroit. It plans to put Boeing 747s into transatlantic service in 1958.

• El Al Israel Airlines carried 5,768 passengers, up from 4,693 last year

El Al hopes to start Benetton service in December.

• Swissair's 1957 summer total was 14,805 passengers, up from 10,590. Breakdown was 11,155 tourist, 3,651 first class. Best month was June with 3,147 tourists, 946 first class passengers. Swissair is now at least of increasing the current first period to three weeks. Swissair reports it is selling well in the two week season.

The Swiss carrier had DC-7Cs in operation during the summer.

• TWA carried 21,854 passengers, up 27% from its 1956 transatlantic total. Tourist total was 15,247, first class was 2,607. Best month was June with 6,800 passengers.

The carrier is a strong advocate of passenger. It says the plan has been a great financial success and has enabled some Canadian who normally wouldn't be able to fly to Europe to visit the continent.

National Strike Ends After 34 Day Period

Washington—National Airlines so named scheduled operations. Tourists who signed a working agreement with the Air Line Agents Assn., to end a 34 day period of suspended operations.

Approximately 3,800 employees were backlogged when the airline brought operations to halt on Sept. 12 following a series of walkouts by the agents. The union had claimed that "the agent and clerical employees of National... never have been on strike... and accused the judges and 'businessmen' of being in on effort to 'workmen at back up' and labor as the main."

Schedule to all points on the coast since the strike was expected to have been ended by September 10. With flight to go back into operation since New York, Washington and Miami.

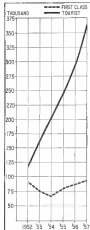
Agreement reached Monday by National Airlines and the Air Line Agents Assn. included the following points:

- General wages are to be adjusted.
- Terms of the agreement are for three years with provisions for wage adjustment after the first and second years and adjustment of wages if negotiations fail.
- Probationary period for new employees are to be six months instead of three months as supervisor's discretion.
- Part-time employees can be used to replace full-time employees.
- Modified union shop agreement will be introduced.

National said that, with completion of survey, it will employ approximately 550 additional employees, including new flight engineers, mechanics, maintenance operations and reservation agents.



LOCKHEEDS departs from KLM Royal Dutch Airlines DC-7C at Amsterdam.



1952 to 1957, all summer traffic rose 18% in June in graph of June/September months.

National Gets Recommendation For Dallas-to-West Coast Route

Washington—National Airlines Inc. has recommended to provide air service between Dallas and the West Coast, a route unopposed by its present route owner.

The internal recommendation was made by Civil Aeronautics Board's Bureau of Operations General V. Mack Grandison in a brief to Examiner Thomas L. Wagon in Dallas to the West Street case. Grandison found National not an unfair entrant, including a simplified outline of its complete against American Airlines, which now provides service between Dallas and the West Coast.

Of the on-schedule airline applicants, a Dallas-West Coast route could be a part of a regular system to Dallas, Boston, Cincinnati and West on. Between Houston, the eastern terminal of National and between the other scheduled applicant—and Dallas, there is a 240-mile gap. The applicant's route that applied for the route, as California Airlines' Houston.

Proposed Route

The route, described by the Bureau created in between the eastern points of Dallas and Fort Worth, the intermediate points Lubbock, Abilene, El Paso and Phoenix, and beyond Phoenix to the western points San Francisco-Dallas and Los Angeles. Grandison said the 240-mile gap between the route might require National to use an aircraft from Dallas to the West Coast but that it could be operated with a profit to National. He and National propose to connect with other carriers in Dallas to the West Coast for its periodic equipment checks and to have the aircraft back to Houston and route them to Miami for major and cargo overhaul.

If National were to be authorized, Grandison said, it is possible that arrangements could be made that would eliminate all ferry mileage. He suggested that Dallas and National might make arrangements of exchanging services between Miami and the West Coast which would permit National to route its equipment to the Miami base on reverse flights.

At present, National, Delta and American operate through service between an intermediate point and the West Coast, but Grandison said that, if either Delta or National was selected, the choice was likely to be reluctant to continue as a partner in an interchange that was competitive to its own service.

Grandison said the Bureau is concerned that the route would strengthen National and provide Dallas with improved service but, because of other factors involved, he recommended the authorization be as a temporary basis. One reason he said is that the route recommended for Dallas to Dallas will be operated in competition with American, the strongest of the domestic carriers which is likely to be involved in the market and operates with the benefit of the back-up traffic from its transcontinental route to the Northwest.

Strong Competition

American also is a partner in interchanges with other carriers to provide a substantial portion of the traffic flowing to the west through Texas points from the South and East. There is a question, Grandison said, as to whether a carrier terminating at Dallas and operating without the support of through service and back-up traffic to and from points beyond Dallas can provide enough stimulus to be an effective competitor.

As a result, Grandison recommended that the Board issue a temporary certificate and then be in a position to provide effective competition by other means should it later appear desirable. Grandison limited to the possible establishment of a fifth transcontinental route in his recommendation that the transmittal of National's authorization be not self-sufficient in its own right, pending dealing with carrier between points on the East Coast and West Coast to Texas points.

"There are applications pending involving such routes," Grandison said.

Comet Indemnity

Pan-Am's Pan Am has accepted the payment of an indemnity from de Havilland Aircraft Co. that amounts the French carrier's loss in their crash-landing suit to approximately \$1,375,000.

An insurer returned the three Comets to de Havilland in 1974 when the product liability certificate of indemnity was a result of a series of accidents. At that time, an Pan Am put in a claim for one provision.

Total amount of indemnity paid to Pan Am, although the three airplanes were purchased for approximately \$5.6 million. The sum, however, was not evaluated and sold to the British Ministry of Supply.

"At some time in the future, these applications will be needed on the Board's calendar and at such time it is desirable that the Board have the relevant freedom of action to permit the authorizations of through services should it then appear that such services are more desirable for the provision of effective competition on the other routes."

Why National

If National is supported by the Board for Dallas-West Coast service it would place the airline in a better position for consideration as a fifth transcontinental carrier in the nearly closed 240-mile gap in the route.

Grandison and the selection of National was based on the fact that the airline's record indicates it could provide efficient service on the face of direct competition. As a result, carrier authorizations to offer a New York-Miami service in competition with Eastern, the current and National has agreed to be an effective competitor and has offered a service designed to meet the needs of the public. He said National has been among the first in the collection of equipment and services to be the first carrier to propose daylight coach service, to promote the tourist package deal and the adoption of the "no-carrier" treatment of passengers.

He said, however, that National is in need of additional route mileage not affected by seasonal problems such as the New York-Miami route. He added first month of National's traffic has been expected to be even by additional competition.

Examiner Approves Permit for Qantas

Washington—Civil Aeronautics Board Examiner Richard A. Walsh today issued last week that a foreign air service permit be issued to Qantas Inc. Airline of Australia, to operate service across the U. S. and around the world.

The permit recommended by the examiner is pursuant to a suit of the U. S. Airlines bilateral agreement concluded earlier this year. It will authorize extension of Qantas' route to San Francisco across the U. S. to New York and beyond to London and Australia.

Although Qantas said the primary purpose of the route is to serve the Australian United Kingdom market through the U. S., it added that it is authorized to operate London to New York. The airline said that the route would not change the basic composition of the route nor would it change Qantas' obligation to comply with the export provisions of the bilateral agreement.

Pan American Renews Great Circle Bid

Washington—Pan American World Airways and five major West Coast airlines asked the Civil Aeronautics Board last week to allow North American Airlines for reconsideration in the face of a proposed transatlantic certificate renewal case.

At the same time, they asked that Pan American be granted immediate traffic rights to Portland and Seattle on the Great Circle Route to the Orient. The four cities are San Francisco, Los Angeles, Seattle and Portland. The statements filed with the CAB had the backing of Governors Robert F. Babbitt of Oregon and Albert D. Rosellini of Washington.

The statements were filed in answer to an earlier petition by Northwest which asked the CAB to reduce its route authorization to the President which would allow Pan American traffic rights at the two cities (NW Oct. 14, p. 40). The recommendation was approved by the President on Aug. 7, but, on Sept. 5, he rescinded his action and asked to hold the decision in abeyance.

Traffic Increase?

In changing his decision, the President cited the possibility that there may have been substantial recent increases in Seattle-Tokyo traffic. He also said Northwest's receipt of a permit certificate on the route route to the Orient through Minneapolis, Cincinnati, Chicago, Alaska, and direct flights from the cities of Portland and Seattle.

Northwest denied there has been any significant change in U. S.-Orient traffic and claimed that the United States granted the CAB in favor of Pan American. The airline and President Lee Harvey Oswald has overruled the CAB Pacific route recommendation on the occasion since December, 1974, such time to the benefit of Pan American.

Pan American in its answer to Northwest said the airline is willing to protect President Eisenhower from oversteering, but has no right to determine what airline should be chosen in a strong disallowing factor, before the CAB.

Pan American Submits

A great deal of Northwest's position, Pan American said, is devoted to plan that the Board, instead of time, nothing to the President what he asked for much the statistics of traffic. He said the U. S. and Tokyo should have these under a review of the route and seasonal matter affecting the traffic, but Pan American carries in cooperation with United between California and Hawaii in competitive with

the Northwest airline Qantas to the South Pacific, and, indeed, to the fact is in still other parts of the world.

Of course, the airline also Northwest said, thus to ensure the traffic statistics between the U. S., Tokyo and the Orient for which the President asked is because the latter are so complex.

Pan American said that in two and one-half years, the U. S. Tokyo-Orient

route of the two carriers has increased work, 1977, and that Northwest's traffic has increased in 1978, for more than Pan American's.

Northwest said its percentage increase is higher than Pan American since it carried three passengers to begin with, but that Pan American's actual increase was greater than Northwest's.

Pan American also said legislation that made Northwest's "route route"



Caravelle Maneuvers a Tight Turn

Caravelle airline is transported through the streets of Toulouse. From plane on to Toulouse-Montaudou Airport. Wings and tailfeet points will also be tracked to the airfield where the complete car will undergo static tests. Trip took three hours, covered 50 miles.



**2-in-1 aircraft
the new**

DOUBLE-DECK JET-PROP VANGUARD

10 FORM OF VANGUARD

The Vanguard's two great lower deck cargo holds can carry 10 tons of the payload—with no modification in the passenger cabin above.

25, 35, 45, 60 PASSENGERS

The upper deck passenger cabin has great layout flexibility... can easily be adapted to all first class, mixed class combinations in all sizes.



STURDIEST PASSENGER COMFORT

The Vanguard is an exceptionally smooth, comfortable with the same jet-prop smoothness and the same big passenger windows that have made the Vanguard so popular.

EXCEPTIONALLY QUICK TURN-AROUND

The Vanguard was designed to reflect time in the ground—allow more time in the air! Thanks to separate 9' 6" wide cargo hold doors and plenty of working space, freight can be loaded and unloaded simultaneously—and in record time. And, to speed passenger handling, there are two passenger doors—each with built-in folding stairs. Finally, the Vanguard has outstanding ground maneuverability—a minimal turning circle and good visibility—permitting faster, safer movement on crowded airports.

**jet-prop VICKERS
VANGUARD**

DESIGNED BY VICKERS AIRCRAFT CO. LTD.

E. J. Thompson, General Sales
10 Bedford Place, New York 17, N. Y.

VICKERS AIRCRAFT CO. LTD. BEDFORD SQUARE, ENGLAND • MEMBER COMPANY OF THE VICKERS GROUP

by the Orient passenger line group. Northwest in turn shares permanent route to Japan and added three semi-weekly-New York, Chicago and Minneapolis-as a permanent basis as compared with Pan American's six two-weekly and a single Sunday service, totaling 1,000 wks.

Pan American referred to the President's letter to the CAB when he last approved the recommendation in which he said: "It is the administration's objective, wherever traffic justifies it, to provide competitive U. S. service on all international and ocean routes from all ports." To enable him to determine whether the traffic would justify such competitive service from Portland and Seattle, the President requested the CAB to review U. S. Ocean traffic periodically and to report to him.

Pan Americans asked the Board to promptly transmit to the President the Board's latest statistics of traffic on the U. S. Tokyo route as requested in the President when he asked that a decision on Pan American's bid be held in abeyance.

Northwest Falters

Northwest also referred to the President's letter in its own statement in its submission. "A sound, balanced, competitive transpacific route structure requires that the President's decision on Aug. 7 be reaffirmed immediately," the airline said. "And the Board, in the primary attitude to the President as international air route matters, should make this firm recommendation."

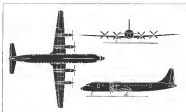
Looking for elements that plan and public demand that the Board withhold from Pan American the new \$1,700-an-California-Tokyo route awarded in the decision of Aug. 7, and respect the entire proceeding, not only such reference to traffic routes at Portland and Seattle, but with respect to the entire Pacific route structure, including Northwest's application which has previously been excluded from the case.

House Group Pushes Investigation of CAB

Washington—The special committee subcommittee headed by Rep. Morgan Moulder (D-Mo.) is moving forward with an "open Canon" investigation of the Civil Aeronautics Board, so that the Board has been accused 100% and has agreed to give staff investigators free access to its files (AW Oct. 14, p. 41).

On one point, however, CAB is hard to badge. The personal records of members, it says, will remain classified.

"Once a congressional committee has,



Russian Turboprop Transport

Three-view of the Sverdlov 18 Moscow, new Russian turboprop transport, shows a more basic design than the Lockheed Electra.

In comparison, the personal thought processes of the independent of judgment is a desired feature."

CAB Chairman James A. Duffice and

Once this independence is gone, the

ministry of judgment is not longer."

Duffice added that, if the subcommittee should want to ignore any

Board members "as to whether he was

satisfied by an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

concerning an action or a decision

possible. Where House demonstrates all of the great political registers agencies.

The subcommittee's last interest is in the North Atlantic and Great Circle route issue. The North Atlantic route involving the \$17 million sale of Aeromarine Overseas Airlines, an American Airlines subsidiary to Pan American World Airways, was decided in 1950 under the Truman administration. The Great Circle route involving the Pacific route owned by Pan American and Northwest Airlines, has been in process since 1954 under the Eisenhower administration.

Antagonism has developed between Duffice and Subcommittee Counsel Dr. Bernard Schwartz, former New York University law professor. At a subcommittee session, Duffice charged that Schwartz had advised him with such questions as "What are you living in?" "What are you coming up?" "What are you doing up?"

Airline Reorganizes Coordinating Council

New York-Times World Airlines has reorganized its planning and coordination functions following the resignation of John L. Weller, the airline's former vice president of planning and coordination.

Under the new setup, President C. L. Boren, senior vice president, the vice president of operations and of passenger service and the general counsel will compose an executive planning committee to formulate and execute TWA's plans and programs.

Airline group under the senior vice president, sales, has been formed for long-term sales evaluating and planning.



ROLLS-ROYCE

GAS TURBINES

for

short, medium and

long range

airliners

Rolls-Royce have over 3,000,000 hours experience in the operation of gas turbine engines in scheduled airline service.

ROLLS-ROYCE LIMITED, DEREY, ENGLAND.

DART PROP-JET

Vickers Viscount - Fairchild F-27
Amesbury Traders Accountant
Armstrong Whitworth 450
Hendley Page Herald and Gannan 159



TYNE PROP-JET

Vickers Viscount
Armstrong Whitworth 451



AVON TURBO JET

de Havilland Comet
Sud-Aviation Caravelle



CONWAY BT-PASS TURBO JET

Boeing 707 - Douglas DC-4



SHORTLINES

► **Thom, Air Lines** of Spain has doubled its African service for Madrid to Spanish Guinea using Douglas DC-1C equipment. Two weekly flights to Bata, Spanish Guinea, via Valencia with a fuel stop at Nanning, French Cameroons, now operate out of Madrid. There is now operating on its sister schedule.

► **Subsided and Western Airlines** has doubled its schedules on scheduled air freight service during the first nine months of 1957, an increase of 10% over the same period of last year. The airline predicts it will push the 12 and has two more weeks to the end of the year.

► **British Overseas Airways Corp.** will begin daily first class Douglas DC-7C service from New York to Nassau on Nov. 30, daily tourist class Vickers Viscount service from New York to Nassau, Managua Bay and Kingston on Dec. 15, daily first class Viscount service from Miami to Managua Bay and Kingston on Dec. 18, three flights weekly from New York to Managua Bay and Kingston in first class configuration on Nov. 10. BOAC reports that the specially fitted Douglas DC-7C that carried Queen Elizabeth and the Duke of Edinburgh to Ottawa from London, made a routine scheduled round trip on BOAC service between New York and San Francisco while the Royal family was on tour. The plane was to be used for the return trip.

► **Civil Aeronautics Administration** has published a booklet outlining procedures and photographs used in radio air traffic control. The booklet, "United States Manual of Radio Air Traffic Control Procedures," is designed to standardize radio control by personnel of the CAA, Army, Air Force and Coast Guard. It covers methods by which radio control can be used by controllers, radio operators, and pilots, radio identification, radio procedures and departures and other communications where radio is applicable. The booklet is available at the U.S. Government Printing Office, Washington.

► **Pas American World Airways** has added an additional European route to its all-cargo service. On Tuesdays through Sundays when the airline has between 230 and 2,540 lb. of cargo booked for Munich, Amsterdam, Düsseldorf, Stuttgart, Munich or Berlin, its all-cargo aircraft will land at these cities as well as at the regular, scheduled stops of Shannon, London and Frankfurt.

AIRLINE OBSERVER

► Passenger traffic continued to climb during September, with the airline industry as a whole showing about a 10% improvement in overall passenger miles over a slightly smaller increase in the number of passengers carried as compared to the previous September. Airlines, however, complained that the increase fell short of forecasts and expressed concern that the rate of increase during the year has not been sufficiently large to justify the steady climb of available seat miles. Also, the annual decline of traffic in September from August was more marked than usual this year and the trend is continuing into October. A sharp dip in the volume of military traffic (AW Sept. 30, p. 47) and business travel has become evident to airline officials.

► **Northwest Airlines** will concentrate on its international route requirements before considering domestic needs when it makes a final decision on its jet transport program. The carrier had hoped to find a jet aircraft that would be interchangeable on both route segments but is now resigned to two different type planes to handle its overall jet requirements and probably will settle on the Boeing 707 and the Comair 580. Northwest is now seeking adequate financial arrangements to back its jet program.

► **Comair** stocks of 80 out of 11 domestic trucking enterprises last year have lost the year during the market slump early last week. Only Eastern Air Lines managed to hold slightly above its price for the year. During the market setback, last Monday, United dropped as low as \$15 as compared with a 1957 high of \$31 and Capital declined to 104 from a 1957 high of 264. Trans World and National also showed large declines as the New York stock exchange. Both Northwest and Continental suffered some losses on the American Stock Exchange.

► **Civil Aeronautics Administration** will undertake body-seated study of instrument flying requirements of helicopters. Progress will begin this week at Washington National Airport with six CAA pilots using an HSS-1 helicopter on loan from the Navy. The HSS-1 is equipped with IFR, VFR and "CVR" communications, terrain, obstacle and distance measuring equipment, ILS receiver and automatic direction finder plus other air-ground instruments.

► **Lockheed Aircraft** is pushing Electra progress in hopes of increasing at least one month of sub-orbiting mission time. Original schedule called for rollout on Dec. 17, first flight on Jan. 30. If the aircraft and program is successful the Electra can fly before the end of 1957. Manufacturers also is proposing a military version of the Electra for troop transport and inter-air.

► **Capital Airlines President David H. Baker** is now recommending to his board office after an extensive period of travel throughout the system but will suggest that top-level staff members adopt similar travel programs as one means of bringing about closer coordination of the airline's activities.

► **William M. Allen**, president of Boeing Airplane Co., says Boeing has achieved a substantial reduction in the unit level of the 707 but not without a decrease in thrust and an increase in fuel consumption. Allen says the overall research and development program on the same supersonic was the result of public choice against jet noise which, he adds, has been greatly improved. Airlines, however, are willing to make the sacrifice. Civil Aeronautics Administrator James P. McElroy said last week in Dallas that one airline had told him it is "willing to sacrifice \$50 million over the life of its jet transport in the form of decreased loads in order to have more supersonic."

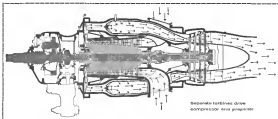
► **Carley Rogers**, president of Trans World Airlines, has called for limitation of government intervention in interfering to "These extreme cases where competition does not work." Rogers said greater discretion by management in terminating and a maximum of line enterprise is necessary to provide the public with a better service.

BRISTOL: Power for the Wings of the World—No. 1



THE REVOLUTIONARY BRISTOL PROTEUS

Most powerful engine in airline service,
cuts fuel costs, solves noise problem



Britain's pioneer free-turbine principle has been proven by actual performance. Powering the Bristol Britannia today, the Proteus delivers greater horsepower than any other engine in airline service—and, with a specific fuel consumption of only 0.446 lb/hp/hr, is by far the most economical gas turbine in either civil or military service.

Pioneer Free-Turbine Design Impresses US Aviation World

US aviation experts who recently examined the Bristol Britannia were greatly impressed by the power, quiet, and all round performance of her four mighty Proteus engines. The engine's remarkable flexibility is the result of an imaginative engineering concept—the revolutionary free turbine principle designed and developed by Bristol.

In the Proteus engine, the compressor and propeller are driven by separate two-stage turbines. There is no mechanical connection between the two systems, only a smooth gas stream.

Variations in propeller speed impose no limits on the output of the compressor and its turbine. The gas-producing section and propeller can each operate at optimum efficiency under all flight conditions—unlike the more limited single shaft turbo-prop engine. It is because the Proteus' propellers turn so slowly that the

Britannia, although much the most powerful, is the quietest airliner flying today.

World's Largest, Fastest, Quietest Jet-Prop Airliner Demonstrates Proteus Superiority

The Proteus is a revolutionary power unit in revolutionary times. It is a dramatic illustration of Bristol's engineering leadership, one of a long line of world-famous aero-engines. The Proteus combines great power with unrivalled economy, versatility, and low noise levels.

The Proteus powers the Bristol Britannia—world's largest, fastest, quietest jet-prop airliner—flying over 400,000 miles a week on BOAC routes throughout half the world. The reliability of the Proteus has been convincingly demonstrated by its outstandingly rapid increase in overall life since introduction into world service only in 1955. Moreover, maintenance requirements have proved to be far below those of piston engines.

BRISTOL
Aero-Engines

BRISTOL AERO ENGINES LIMITED ENGLAND

AERONAUTICAL ENGINEERING



REAR view of Dassault Etendard 6 clearly shows the swept MiG-type geometry, even in the high air disk tail layout.



MECHANIC stands Dassault Etendard (above, left) without pilot's seat. Etendard 6 now (top right, above) gives pilot excellent visibility against ground targets. Leading edge of Etendard is wing (bottom right, above) has been extended to create wave pattern.

Sifting Begins of Lightweight Fighters

By David A. Anderson

BRIEFING. FRANCE-SHARPE headquarters is sifting through results of the NATO light fighter competition here with the usual daily routine of news conferences to the various NATO member foreign embassies to consider one or more of the five entrants.

All five were in flying condition at the end of the 158 flight tests in the trials. Each nation's requirements were the basis of the competition, with the aircraft required to operate from unimproved fields and deliver nuclear or conventional weapons against enemy concentrations.

Designers were expected to produce planes capable of Mach 0.95 in the climb, able to take off from paved steel parking, gross at a lightest, able to climb 50 ft. or less than 1,000 ft. and able to roll at 100 deg. per sec.

Adequate navigational and communications equipment had to be included; the cockpit had to be pressurized and the whole machine had to weigh in at less than 17,000 lb. empty.

Three planes were built to that requirement around the Bristol Oryx 1 (top left); Breguet's Taon; Dassault's Etendard 6 and Fiat's G.91. Two

entrants not designed to the specification were also competing, powered by Seneca Air turbojets: Dassault's Etendard 4 and Sud Aviation's Brumaire. The five were flown through a series of simulated missions and routine flight trials by a pool of NATO pilots.

None of the five meets all the specifications in the way it is determined. None, at the three Oryx-plus-plus missions, even closely meet the climb requirement. Their thrust-weight ratio, originally planned to be about 1.2, has steadily slipped because of equipment additions or structural modifications.

Neither of the Atargovest plans can meet the maximum weight limit. The Brumaire, for example, weighs in at close to 10,000 lb. empty, which is twice the basic of the specifications. The Air turbojets show weight close to 7,000 lb. installed.

But Breguet and Dassault both have talked about advanced versions of their designs to be powered by the Bristol Oryx 12 rated at 6,000 lb. without afterburner and 8,170 lb. with. These could be "production" versions, say the companies, and would differ in detail, dimensions and weight from the original ones being tested. But such advanced versions could meet the

specification performance, they add.

Dassault has a third string to its bow. It has entered the Atargovest Etendard 4, which it says corresponds to a future Etendard 4 with an Oryx 12, similar to thrust-weight ratio type.

So the competition boiled down to a flight evaluation of five airplanes, none of which meets the specifications and none of which is a true prototype for an aircraft that meets the specifications.

Descriptions of most of the competing aircraft have previously been published in *Aircraft Weekly* (AW Sept. 10, p. 26), but new details on some of the planes were revealed during the trials.

Breguet's 1001 Hanelly was the best of the entrants to take to the air, beating the competition by some margins. While competitors were making the climb, Breguet engines were slowing the acceleration of the light fighter and working it to keep the airplane up to date.

From an engineering viewpoint, the Taon is about the most sophisticated of the entries. Aerodynamically it is a true configuration with low air disk tail, swept-back geometry and other tricks at the back. Structurally it uses large sections of aluminum honeycomb fabrications, tapered wing skins and subsonically



RUBBER of Fiat G.91 (top left above) is thicker than on winged jets and has more, but not less, than on rigid side panels. Base of tail (right, above) is heavier to accommodate structural changes made on horizontal surfaces.



Choose **TORQ-SET** and get both:

... all the
advantages of
cold-forming



... unlimited
mass production
of both fasteners
and driver

You get both of these critical features in TORQ-SET, the aviation fastener that lets you use one socket design for every aircraft fastening location. You get extra strength because it is a completely forged, single-piece unit, plus all the benefits of mass production in any size, style and head configuration. What's more, TORQ-SET offers extra in performance, too. It has the greatest wearability known in aircraft fasteners. It tightens tighter without heating or distortion and can be power-driven. Yet the TORQ-SET design lets you remove it without difficulty.



Find out how TORQ-SET can solve your aircraft fastening problems. Write, wire or call American Screw Company, Willmar, Minn.

The biggest news
in fasteners comes from ..



American!

AMERICAN SCREW CO. • WILLMAR, MINN.
Minneapolis, Pa. • Chicago, Ill. • Detroit, Michigan

West Coast Sales Office and Warehouse: Air Industries of California, 9321 W. Hyde Park Blvd., Inglewood, Calif.

breakdown ground to a high rate of production.

Wingspan is the smallest of the entries at 21.5 ft. Overall length is 34.9 ft and height in the flow-past attitude is 12.5 ft. Weights are not available, but the efficient use of honeycomb should make for an overall lightweight structure.

A clue to the weight saving of the engine is given in the performance brochure, which presents parameters plotted against the weight. Maximum weight shown for landing performance is about 6,500 lb and maximum shown for climb is about 11,000 lb.

Titan has power controls with air-

craft fuel on all three sections around all three axes, plus a yaw damper in the directional control system.

Wing Construction

Wing area of the Titan is about 320 sq. ft.

The wing shell is made basically of two tapered skins bonded to an aluminum honeycomb core. To this cross-bonded panel are fitted the double-slotted, two-segment trailing edge flaps, the leading edge slats, the ailerons and spoilers.

The fuselage is broken into four sections for production. The main nose section houses all of the avionics gear.

Cockpit and dual seats form the second portion, which is honeycombed structure.

Main fuselage section is also a honeycomb assembly and contains the wing roots through structure, armament bays and fuel tanks with a total capacity of 450 U.S. gallons. Fourth section is the tail cone and houses the engine, accessories and fuel pipes, and mounts the vertical and horizontal fins.

Landing gear was designed and built in the French Maseran line. It is a semi-conventional tricycle type, with large, low-pressure tires and independent suspension. Main and nose wheel air pressures are both 58 psi. Landing gear



ORION enters service on August Titan (left, above) is down during brief at NATO trials. Low at left (left) is contemporary layout of August design. Note relatively small size of wing, low thickness-to-chord ratio of wing and horizontal tail. Low pressure tires (below) are feature of Titan.



CUTAWAY shows original structure of August Titan. Vented intake under nose has been retained on prototype, speed brakes added under belly.



You'll see this used quite a lot by our customers. It's the combined application of imagination and engineering skill that results in a better way to method for making a product—the special inert gas chamber we designed for controlled atmosphere welding of titanium.

You see, we operate on the principle that anything can be made better or more quickly.

Our engineering and production specialists are constantly examining production methods to determine if new ways can be found to increase

the quality of the job and, at the same time, lessen production time and cost.

In some instances, we have shared production time in half on certain manufacturing operations of the J57. Of course, it takes skill, experience... and ingenuity.

Our customers have a lot of such.

This ingenuity is no important factor enabling us to deliver quality jet engines, on schedule, at the lowest possible cost.



AIRCRAFT ENGINE DIVISION • FORD MOTOR COMPANY
7401 SOUTH CICERO AVENUE • CHICAGO 29, ILLINOIS



TACON second fighter is development of original design. Wingspan at 22.5 ft., overall length 36.9 ft., height at three-point attitude 15.1 ft.

total is 5.5 ft. wide and the wheelbase is 13.1 ft.

Aircraft gear on the Tacon includes an ARC-58 UHF set, an AFX 6 IFF and coder equipment, an MBQ-1 set consisting of an APA-55 and APW-11, a Beech NA-AN-55 radio-computer or, if desired, a Marconi unit, an ARN-21 Tacon equipment or a CTA-422 position analyzer, a telegraphing set for operational briefing and a Beech Type 30 gyro compass.

Tacon Armament

Standard armament on the Tacon is four Browning 50-cal machine guns, but these may be replaced with two French 30-mm DEFA cannon with 240 rounds or be two Mauser 20-mm cannons with 15 rounds each. External armament is carried on four wing pylons and includes in alternate loads two napalm tanks of 160 lb each, 12 UK rockets, two five inch HVAR rockets, two Matra 115C rocket adapters or two Nord 5101 guided missiles.

Late after entry in the competition, the Tacon has two additional configurations offered. The photo-reconnaissance version results in a modified nose section to accommodate the four cameras with the left armament bay deleted and the right armament bay offered either with two 35-cal machine guns, one DEFA cannon or an extra fuel tank.

The trainer is a two-seater built around the Cyclone 4, a detailed Cyclone 3 with reduced fuel consumption.

Report says the production airplane is dropped around the Cyclone 17, and that the company has worked out the details on a two-seater with the Cyclone 12, and either for training or for other work.

Described Standard

"The Standard ('Fly' or 'Bomber') version, now numbering eight different

aspects of which two are flying, is based on the maximum priority of the company's highly successful gas turbine engine, the Super Myrhone 5.2. Scaled down, the same aerodynamic layout is used for wings and tail surfaces, in a complete, aspect view and aerial action.

Description of the three original proposals of the action was published elsewhere in *Aviation Week* (Oct. 13, 1955, p. 25).

Elendard 4 and 6 are flying in the competition. Both were designed to a single specification, the 4 to a French ground-support role and the 6 to the NATO light-sight reconnaissance. The Elendard 4 is powered by the Sauron Star 3 and the Elendard 6 is powered by the Bristol Ophion 3. Detailed consideration of the Elendard 4 is flying equivalent of the production version of the Elendard 6, which would carry the Bristol Ophion 12 engine. The company says that in short weight ratio and wing loading, the two planes are almost identical.

Area Rule Followed

Desmich proposes that production Elendard 6 aircraft should also incorporate the improvements being made in a version of the Elendard 4 being developed for the French Navy. An example of the aerodynamic improvement.

Additional designs have been made for two-seater and photo-reconnaissance versions of both the Elendard 4 and the Elendard 6 with Cyclone 12.

Wingspan of the Elendard 4 is 22.9 ft., overall length is 39.5 ft. and the three-point height is 15.5 ft. Weights are not available.

Landing gear take pressure are high on the four corners of 4 ft. Trend of the trends gear is 10.1 ft. wide and wheelbase is 12.0 ft.

Cockpit of this airplane is not pressurized, but is non-pressurized. A con-

Waugh AERIAL REFUELING FLOWMETER

Waugh model MR-42 inflating turbine flowmeter has been selected for the tanker version of the Douglas A-50 Skywarrior to give precise measurement and control of fuel transfer.



FEATURES:

- Simple, reliable turbine assembly on flow meter actuates master and signal lights for atmospheric detection.
- Signal light to indicate transfer of fuel is mounted directly from flow meter.
- Slowly rotating turbine gear is the only moving part—no relays or mechanical contacts.

Write for complete data: Bulletin 105/400

Also available: Flow Rate Indicator and Recorder, Fire quantity-in-flight Converter, ground-pourage Flow Sensor.

Waugh ENGINEERING COMPANY
1000
2140 BURNER AVENUE, SAN JOSE, CALIFORNIA

A NEW CONCEPT FOR USAF TRAINING

Cessna's T-37 now in operation fits the new concept in USAF training: an easier transition into jets for Air Force Cadets. Side-by-side seating, combat flight characteristics with handling ease result in substantial training savings.

CESSNA AIRCRAFT CO., WICHITA, KANSAS



vertical oxygen system is provided. Standard ejection gear and ejection seat is included in the design.

Extended 4 is Different

Extended 4 is quite a different airplane, although at first glance it looks like an identical twin to the 6. Its larger engine was the result of the French specifications, which called for heavier aircraft than the NATO installations of four 18-cyl. machine guns.

The Extended 4 carries a pair of French 30-mm DEFA cannons with 150 rounds per gun, plus a retractable rocket launcher with 32 rounds in the fuselage aft of the cockpit. In addition, ejection seats can carry a variety of external weapons.

Wingspan of the Extended 4 is 31.1 ft; overall length is 40.0 ft and the three-point height is about the same as the Extended 6.

Landing gear has provisions been lowered in this design to 50 psi. Wheel track is 13.9 ft, and wheelbase is 16.7 ft.

Two-Seat Design

Dassault's design for the two-seater version replaces the rocket launcher installation with place for a second pilot. Normal movement is achieved for operational version too. The communication system of the Extended 4 uses a photo camera pack to place of the rocket launcher, changes the nose section for a nose fitted with basic camera, and carries additional navigational equipment while retaining the pair of 30 mm cannons plus the ejection equipment of the original.

Dassault's primary bid for the NATO contract is the Extended 6 with the Oxyrhynchus 12 engine, rated at 4,800 hp thrust and increased to 4,170 hp thrust with afterburner (originally called "Worldbeat" but now designated by the designation of 1033, for Bristol-Simpson-Reheat). The Oxyrhynchus 12 is longer by about three feet and weighs about 140 lb more. It also requires more air mass flow which causes some inlet area and therefore more fuselage cross-section area. Since the fuselage had to be redesigned anyway, Dassault made the area rule modification it had incorporated in the drawings of the Extended 4M for the Navy.

The Oxyrhynchus 12 version also requires more fuel for the NATO mission, but fortunately this could be accommodated in the extra fuselage dimensions required for balance and inlet area. The fuselage has been stretched aft to house the engine and the cockpit has been moved forward to balance the input. Wing area and empty weight have been increased, the allowance for extra weight includes cockpit prescription (another item of Dassault design insurance put in case anybody wants

LEWIS WIRE PRODUCTS

HIGH TEMPERATURE CABLE...

Suitable for operating temperatures up to 400° with nickel-clad copper conductors and laminated insulation having superior dielectric strength and moisture resistance. Is JANS spec 22 thru 4/32. In accordance with MIL-C-13028.

ELECTRONIC HOOKUP WIRE...

Twisted insulated silver copper conductor with insulation in standard colors in accordance with MIL-C-14479.

EXTRA FLEXIBLE CABLE...

High Temperature and Moisture Resistant Electrical Cable Known "THERX" Cables, single and multi-conductors, superior for circuits on bent or pressed parts. Resistant to abrasion and temperatures to 500°F.

HEATING CABLE...

with nickel-chrome conductors and laminated insulation for operation at 200°F, extensively used by control stations to maintain proper temperatures in pipe lines exposed to wide variations in ambient temperatures.

GLASS & ASBESTOS INSULATED HEATING CABLE...

with stainless steel braided shield for special high temperature applications, used by atomic energy facilities.

CUSTOM CONSTRUCTED CONTROL CABLES AND THERMOCOUPLE-WIRE CABLES...

with ungrouped circuits individually shielded, and with on-on-shielding or with special shielding and jacketing.

FIRE-RESISTANT AND HIGH TEMPERATURE RESISTANT CABLE...

for circuits required to operate in 2000°F. Same for fifteen minutes. Insulated for fire-detection circuits and for use in temperatures up to 600°F.

THERMOCOUPLE WIRE AND EXTENSION WIRE...

In thermocouples, copper-constantan and chromel-alumel in MIL spec'd colors or in custom constructions. Twisted and shielded, twisted, shielded and jacketed. Multiple-pair cables, shield and jacketed for marine applications.

RESISTANCE ELEMENT AND UNITS...

Ceramic and flexible heating elements and units for low wattage applications as heating pads, heaters, curing ovens, trays, wire marking machines, etc. Insulation of asbestos or glass or in constructions of both.

By utilizing and combining the various qualities of tin, lead, aluminum and positive resistance of asbestos, glass, asbestos and Teflon®, we have developed many special wires and cables for atomic and electronic applications. We invite inquiries for cables and wire constructed to customers' specifications for special applications.

* DuPont Trade Mark

The LEWIS ENGINEERING COMPANY

WIRE DIVISION
NAUATUCK, CONNECTICUT



Bill Remmert brought R-W service to Pompano. Seated here, a DC-4 conversion near completion.



Bob Werner works most of his time at Remmert-Werner's home-base operation in St. Louis.

Remmert-Werner... Big-Change Artists

Over 200 aircraft conversions . . . thousands of corporate planes maintained and serviced . . . millions of gallons of Shell Aviation Fuel sold to satisfied customers—that's Remmert-Werner's 10-year record!

In June '56, a caravan of three giant mobile units left Remmert-Werner's home base, Lambert-St. Louis Municipal Airport. It was headed for Pompano, Florida.

Bill Remmert met the caravan. Utilizing its complete machine, woodworking, and electrical shops plus radio racks, stockroom and expert mechanics, he established another R-W staffed base.

"When we took over the Pompano field," recalls Bill, "we needed fueling equipment—but Shell engineers came down and designed our bulk plant. And almost before we knew it, there were the three 15,000-gallon storage tanks we ordered waiting out there on pilons, ready to go. Shell helped us zoom into business."

Besides servicing a good number of America's 38,000 corporate planes, Remmert-Werner also converts surplus commercial and military aircraft into luxury planes for private owners and corporations.

In an ordinary conversion job, R-W rigs out every bit of wiring and plating, and installs completely new systems to customer specification. Lounge chairs and sofas, tables, lamps, galleys and any other special furnishings are designed and built by R-W craftsmen.

Among the organizations that happily fly Remmert-Werner conversions are Olin Mathieson Chemical, Grumman Aircraft, Hercules Powder and Owens-Illinois Glass.

"It didn't take long for us to find out that when you're a Shell Dealer, business flows your way," says Bill. "Shell works right along with you, helping you build your business. They've even helped us locate old DC-3's when they've been hard to

get. A Shell man spotted some while traveling in Turkey last year. We went right over there and bought them. Most of those '3's have already been converted into flying palaces."

If their first 16 months at Pompano is any indication, Bill Remmert and Bob Werner are on their way to making R-W service available to America's ever-increasing fleet of corporate aircraft.



Before: C. S. Weeks (right), R-W sales manager, and client discuss plans for a Grumman "Dove."



After: R-W serviceman tests a converted "Dove" with Shell Aviation Gasoline.



Before: R-W craftsmen remodel interior of DC-3. They'll install new wiring, insulation, picture windows, and furnishings in order.



After: Betty Remmert (right) shows prospective client through completed interior R-W conversion sold for as much as \$300,000.

It pays to be a Shell Aviation Dealer
—and the Shell office nearest you will be glad to show you why



FASTENER PROBLEM



Miniature right-angle stop nut for cover hold-down saves space and weight on avionics unit

This is United Control Corporation's advanced Master Warning System Control—designed and developed to reveal any aircraft system malfunctions. It is used on the expensive Republic F-105 Thunderbolt and like all its more components this expensive must be held weight, compact and highly dependable.

THE PROBLEM: How to attach a clear cover securely with provision for easy removal for inspection and a high degree of fastener reliability. Yet this fastener, also had to be done without excessive weight and space allowances.

THE SOLUTION: A miniature, right-angle basket nut—Type A27M—especially developed for liquid mounting applications, with a built-in one-piece locking insert, provided the answer. A built-in "flange" permits the nut to be self-locking in comparison to a standard nut. A standard nut requires a separate lock washer and a lock nut. If high inspection had been a problem, ESNCO could have supplied Type A27M which has the same features as Type A27M plus an additional type of locking device which will allow fastener to be removed.

YOUR FASTENER PROBLEM can be solved as easily and efficiently as this right angle basket nut application. So why not start your design today?



ESNCO's line of right-angle basket nuts, shown above in cross and side views, includes the standard ESNCO fastener which is used in most applications. The A27M nut and the high level of performance ESNCO has.

MAIL COUPON FOR DESIGN INFORMATION

Dept. 1045-1052, ESNCO, One West 10th Street, New York, New York

Please send me the following ESNCO literature (no money):

☐ Data sheet on Type A27M and Type A27M ☐ I enclose a drawing of my product. Will you let locking bracket be my request?

Name _____ Title _____

Firm _____

Street _____

City _____ State _____

an intercepter mission flown with these aircraft).

F-105's 50-cal machine guns and 3,200 rounds can be carried in the standard armament, but since there is more room for armament in the fuselage, it is possible to use either a 500 round 30-cal. cannon pack or to install a rocket launcher with 55 2.75-in. rockets.

Avionics gear has been increased to include mapping radar and Douglas's "Aids" equipment which gives range, azimuth and elevation of the target on cross-polarization, providing what the company calls "zero-weather flying" of the aircraft.

Two versions of the Standard 6 can also be made into a two-seater or a photo-reconnaissance airplane.

Wingspan of the Standard 6 with Option 12 is 38.0 ft., overall length is 42.3 ft. and three post height is about 11.5 ft. Landing gear track is 10.8 ft. and wheelbase is 14.2 ft.

Fiat G.91

Italy's pride, the Fiat G.91, was extensively described in *Aircraft Illustrated*, June 18, p. 50. Since the flight tests of the first prototype, which were ended when the plane broke up in the air following tail failure, Fiat has modified the plane in a couple of respects.

Most obvious is the tail fin. Base of the vertical tail has been widened and internal structural changes have been made to prevent the troubles from happening again.

Main wheels, which on the first prototype carried 64 psi tire pressure, now carry only 50 psi, according to the officials on the test team.

In addition, the cockpit has been raised about one inch, a vertical air strip has been added and the horizontal tail dimensions were increased.

Performance is considerably improved over the first prototype which was powered by an early Olympus.

Sud Aviation

The Recorder ("Tough Guy" in legend slang) is the latest of only two rough-neck capability. Anyone who has observed the breathtaking speed run of the craft under the skilled guidance of Sud's Test Marshal or USAF's Major Arthur (K1) Murry, is always impressed. It's not until after that the observer is inclined to be glad that someone else was making the climb.

It is an awesome sight to see the Recorder rocking along over the taut, twisting a long plane of dust and swirling earth behind it, bounding from the strip to the runway like a new plane on the way and leaping into the air from the last of the bumps, all after a run of less than 2,000 ft.

But once the spectacular climb is



fog-free visibility with Sierracote

The plastic canopy of Conquest's new supersonic all-weather interceptor—the F-106A—is coated with Sierracote to provide an electrically heated fog-free surface.

The achievement of a Sierracote-coated development program extending over several years, Sierracote is providing an anti-icing for two single, significant reasons. It prevents formation of fog on heat surfaces of windshields and canopies, and reflects up to 75% of solar heat rays. In addition, it is electrically insulative, transparent and is a reliable material of compound structure.

Today, this efficient coating is providing better visibility in Conquest's new Delta Dart and is often used on aircraft. A new technical bulletin describing Sierracote in detail is now available. Write for your free copy today.

Sierracote is a new, electrically-conductive, transparent coating that provides a fog-free surface for plastics and glass.

The Sierracote Corporation
1111 Antioch St., Newark, California
Conquest: William H. Conquest, chairman and
a copy of our new Sierracote Bulletin No. 100

Research with Whelan

Research at Sierracote Corporation is concentrated on development of electrically insulative and electrically conductive transparent coatings. Thickened Sierracote is available in spray-applied form for coating protection.

SNARK

BOMARC

FALCON

MATADOR

PROFILES OF EXPERIENCE

by **LIBRASCOPE**

The demands of computer and control projects and problems over a 10-year period have earned for Librascope an enviable record of experience which is demonstrated by versatility and reliability in the design, development and manufacture of successful equipment. New demands of missile projects are reflected in Librascope's profile of experience. This knowledge can be focused on your computer-control problems with the assistance of experts. Librascope invites your inquiry in this field. A detailed request will bring you the Librascope story.

Engineers interested in challenging new fields are invited to contact Glen Salzer, Employment Manager.



LIBRASCOPE INCORPORATED • 808 WESTERN AVENUE • GLENDALE, CALIFORNIA



SR-177 Configuration

Model of Saunders Roe SR-177, small, powerplant, ultraminiature, delta, Finetank, rocket, mounted on wings. Naval off weather, high altitude plane will be powered by de Havilland Gema Junior supercruise turbojet and fully controllable de Havilland Specter rocket engine. Overall configuration suggests that plane will operate in Black 2 range. SR-177 is somewhat larger than SR-51, carries more operational equipment. Combination of rocket and low landing weight should permit short runway, tactical air strip operation.

Landings have been demonstrated. The standard of the concept begins to sink in.

This airplane, equipped with delta instead of wings, can considerably take off from any surface that can support the weight of the plane.

Skid pavement on the ground is a few ft. long.

The plane can taxi well on the ground, and one of the plane's features that dig into the ground gives excellent maneuverability. Forward wheel is less than 45 ft. Rear wheel is a few feet and a light truck plus one person motor.

Bombardier Well Tested

The Bombardier first flew four years ago. Since then it has been operated from isolated desert surfaces at Fort Huachuca, plus with heavy vehicles at Valancourt on vapor, regular earth like, paved field at Fort. on the beach at La Bunka and on a isolated bombed area wing with rocket field with loose earth at San Nasser.

The company says that the Bombardier has then proven that it can take off from fields where only a command air type of vehicle could move and on land on fields in which these vehicles would be trapped down.

Wingspan of the Bombardier is 32.8 ft., overall length is 44.5 ft. and three point height is 18.8 ft. Gross weight is 15,575 lb. and the weight empty is about 9,412 lb.

Merger With Monroe Planned by Litton

Impending merger of Monroe Calculating Machine Co., with Litton Industries was announced last week. Stockholders of Monroe representing approximately 50% of that company's stock have accepted the offer of board of directors of Litton to purchase out standing common stock.

Monroe stockholders have been offered the choice of 14 shares of Litton common stock for each share of Monroe common or 4 of one share of Litton \$5.00 par value 5% preferred for each



Add Launchers

Two additional launching pylons installed for Falcon missiles are tested on special Nonhanging F-40000 launchers at Edwards Flight Test Center. Pylons formerly installed are under each wing, plus tip pylons.

RADAR SYSTEMS

MAXSON

Over 33 years' experience in development and manufacture of systems for airborne, airborne, and missile units.

Ask for latest literature brochure

THE V. L. **MAXSON** CORPORATION

425 TINTY AVE., NEW YORK 16, N. Y.

EXCITING! Contact our District Personnel Manager for employment data

A aviation history can be told in numbers, and 880 seems destined to write a page of its own. In 1960, Convair 880, the world's fastest jetliner, will be in service. 880 will cruise at 615 mph, carrying 80 first-class or 108 coach-class passengers. The new Convair will combine spacious luxury and unprecedented commercial speed with operating economy.

Power will be four CI-805's—General Electric's spectacular turbojet. CI-805 is a variable stator, single rotor engine in the 10,000 pound thrust class. J79—its famous military counterpart—drives aircraft at twice the speed of sound!

UAP components are supplied to GE for both the CI-805 and J79, as listed below. Here development was a challenge because the GE turbojets were designed for a higher thrust-to-weight ratio than any large jet engine in production. To meet specifications, UAP developed components of minimum weight and maximum compressive strength with highest strength and optimum performance. If you require dependable, high-quality aircraft essentials, often exceeding specifications in design and manufacturing, UAP will prove a versatile and reliable source. Write today for information.



GENTLE, EFFICIENT, SPECTACULAR—UAP'S

AIRBORNE AND NAVY
CI-805 TURBOJET

Full control valve
Leak-proof hydraulic oil tank
Aluminum main and afterburner fuel lines
Fuel cooler

COMPARING VISION (right)
CLOSED FOR CONVAIR 880
Built-in No. 0 light-to-light heat exchanger
Turbine with water-cooled bearing with control valves

a famous family of aircraft essentials since 1929

UNITED AIRCRAFT PRODUCTS, INC.
1116 BOLANDER AVENUE, DAYTON, OHIO

share of Mexican aviation. Approximately 380,000 shares of Mexican common stock are outstanding.

Mouse also for the current calendar year are estimated to exceed \$40 million and company's current total supplies went to over \$300. With the inclusion of the sale of Montreal Electronic Mfg. Corp., and Aerosol Radio Corp., Latin Industries' annual sales are currently at the rate of over \$45 million.

88 Million Engine Order Placed by West Germans

Geneta Engines Ltd., Toronto, Ont., has received an order amounting to \$8,000,000 from the West German Air Force for spare Orenda 14 engines and parts. The order is the first for spare parts months ago by the West German Air Force for 125 Canadian Sabre VI fighters equipped with Orenda 14 engines. The order for spares must be completed by next August.

Magnetic Tape Recorder Ordered for Navy Planes

Bureau of Aeronautics awarded a \$1,240,000 contract to Autotronics a division of North American Aviation, Inc., for a jet line government of an advanced airborne magnetic tape recorder. Device is capable of recording voice and automatically recording the attack display information of the fire control system. Known as Model VIII, recorder is planned for installation in several all-weather Navy interceptors.



Pressure Suit

Scientist shows he can now breathe while wearing pressure suit that protects him from 95 mm altitude simulated in Latin Industries, Inc., chamber developed for Air Force ARDC (AFM Oct. 14, p. 81).

THESE ARE THE FACILITIES OF

CLEMCO
AERO PRODUCTS, INC.

geared to lead the field of aircraft and guided missiles for the world today...for the universe tomorrow



CLEMCO's Research, Engineering, and Production facilities have been carefully planned to provide and maintain the highest performance. More than 300 engineers, technicians and highly skilled craftsmen with a high degree of mechanical training, now employed in CLEMCO's 80,000 square foot plant.

all working together to provide the aircraft and missile industry with products of superior quality and complete dependability.



Hold Place with a four stage vacuum chuck table. Hold Place with four foot lead clearance over 32" x 141" table with vacuum chuck plate combined. Location: Floor and 3rd and 4th.

10 1/2 Footprint ranging in size up to 10' x 170" table.

20 Milling Machines of all sizes in largest time base 1000.

Precision machines providing final production stage of complex at CLEMCO.

The CLEMCO Tool Laboratory is a vital necessity in the development of hydraulic and pneumatic products.

Complete testing facilities for structural analysis and complete.

CLEMCO's engineering facilities are at the heart of the aircraft and missile industry.

Assembly for prime work units. Major function of CLEMCO.

CLEMCO AERO PRODUCTS, INC. now furnishing the leaders of the aircraft and missile industry with the following:

ROCKET ACTIVATION
POWER STEERING UNITS
FUEL SYSTEMS
MISSILE RIG AND SPARS
HYDRAULIC AND PNEUMATIC UNITS FOR AIRCRAFT AND COMMERCIAL AIRCRAFT, AND MISSILES

Write for complete Clemco folder to



CLEMCO
AERO PRODUCTS, INC.
310 E. Mainville St., Compton, California

One of a continuing series of information presented monthly for the advancement of the aircraft industry by CLEMCO. Page 100 or more in this volume from the complete series of CLEMCO.



the **TECO PLAN** cuts seat-buying time and costs for leading Airlines and Aircraft Companies!



Trust From handshake to delivery the TECO PLAN works smooth and simple. Smooth, because it helps Airline and Aircraft Manufacturers' Engineering and Purchasing people cut time and outpower costs, simple, because with the TECO PLAN there's nothing new to learn... but rather, a way for you to do less and accomplish more!

With selling requirements for both present and

future airline and aerospace aircraft becoming more complex and the "buying eye" cutting for new and better cost-saving procurement methods, we sincerely invite you to investigate the TECO PLAN in its entirety.

A TECO representative will be glad to point out the time, money, manpower and TECO airline seat savings you will receive!

passenger seating for



airline, executive aircraft, high-density conversion, berths, coaches, crew ability seats

TECO INC.

8210 Wilshire Avenue, Burbank, California

IN CANADA: Railway & Power Engineering Corp., Ltd., Montreal • MIDWEST & SEATTLE: G. E. Harris & Co., Wichita

Russian Scientist Wants Students Assigned Earlier to Engineer Work

Moscow—A top Russian Air Force scientist is in sharp disagreement with leading members of the USSR's famous Zhukovskiy Air Engineering Academy over how soon students should be assigned to practical design and development work.

V. Pugebech, Major General of Engineering and Technical Science, writing in the Red Army newspaper Red Star, advocates that Russian aviation engineering students who have completed their second year should participate in specific development projects as part of their academic training.

He says that the academy's method of solving problems not understanding Red Air Force scientists demands that future engineering officials who have passed their basic theoretical courses be given practical assignments immediately.

Pugebech, who is also a professor and doctor of technical sciences, complains

that most of the diploma projects of Russian aviation engineering students have done so many times before the individual's book learning, since they never find practical applications.

Professors' Object

But some Zhukovskiy Academy professors stoutly defend the existing method of instruction and diploma project planning. They point with pride to the design of directing students from "deep theoretical study" and argue that Pugebech's plan would transform the Zhukovskiy Academy and other Soviet air engineering institutes into average grade design bureaus.

Pugebech first presented his proposal at a scientific conference of the Zhukovskiy Academy's staff. When they heard still opposition, he sought support for his case through the USSR's official Defense Ministry newspaper Red Star.

The general admits that his suggestion cannot be adopted at once because they will require considerable change in the Zhukovskiy Academy's program.

But he stressed charges that his proposals would turn the Zhukovskiy Academy into a design bureau.

Fears Are Groundless

Such fears are the part of the professors are groundless. Science and study scientific solutions to practical problems are irrefutable without thorough mastery of theory. A student's effort to do independent creative technical work is an additional stimulant which urges him to study all the scientific knowledge in a given field.

Furthermore, the design experience acquired by the students at the engineering academy will be of great help to him when he graduates and is assigned to practical, creative work in an Air Force unit.

In his Red Star article, Pugebech declares:

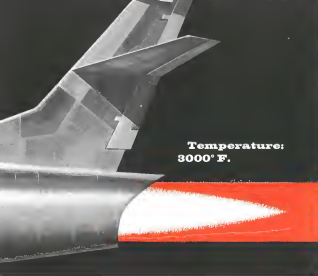
"The theoretical and course work and the diploma projects of aviation engineering students are and must be



Russian Meteor Rocket Firing

Russian Meteor rocket, used in IGY program, shown in firing trials about one ton, stands 29 ft. high. It is so offset a three-stage rocket, with the first stage a hollow cluster of six solid propellant rockets. Second stage contains, with nine solid and rocket boosters as propellants, first through the use of this cluster, and is started at the same time as the boosters firing boosters burn out at low altitude, but rockets carry the bulk of the rocket to about 44 mi. at maximum height. Small solid

fuel rockets operate the same course and extend the trajectory. At separation, the main stage becomes a parachute which leads suspended in the flow of air high altitude. A second parachute forms the main body of the rocket with its sustainer (short cluster) to earth (right). Near coast parachute opens at about 40 mi. on the descending leg of the trajectory and uses the subsonic air to earth slowly. Below: photo of Meteor appeared in Aviation Week Sept. 9, p. 42.



**Temperature:
3000° F.**

Dual orifice fuel nozzles control the flow of fuel to the combustion chamber of a jet—hot as a blast furnace! The advanced design and precision manufacture of these nozzles provide optimum engine combustion efficiency. Ex-Cell-O builds such fuel nozzles...along with blades, rotors, actuators, valves, fuel controls, parts and assemblies.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION **XLO**
Aircraft Division

MAN AND MACHINES FLY SMOOTHER, FASTER AND SAFER WITH PARTS AND ASSEMBLIES BY EX-CELL-O

...which led to present practical problems.

This will enable our future engineers to assume a higher degree of responsibility for developing theories in their chosen field and to prevent them to become accustomed to solving practical problems as their job.

It seems to me that beginning with the third year when the students have acquired the basic engineering skills, they are able to carry on useful practical work, which is, at the same time, an essential part of their academic training. To do this, the nation's student's curriculum must be expanded so that each upper division course, laboratory or practical requirement is an integral part of the scientific research work being conducted in a particular class.

"As for the students' diploma projects, it is essential to choose such those subjects which have actual significance to the armed forces."

Old Concept

Papadakis noted that his ideas are not new. In certain facilities of the LeCompté Polytechnical Institute students in their third and subsequent years do independent scientific research work in laboratories as part of an overall project that is being solved by a class.

Diploma projects at the Moscow Physical and Technical Institute are based on practical problems.

"In my opinion," Papadakis continued, "students diploma projects at the Moscow Air Force Technical Institute must acquire a final design element of some kind of machine technology which has been brought to the drawing board stage."

The project must consider the requirements of actual operations or employment of the design. Thus the students work can be used to accelerate the creation of new types of military hardware.

Good Administration Required

Papadakis concluded that adoption of his ideas would necessitate a fairly substantial amount of Air Force engineering assistance.

He said that department heads would have to be convinced more of actual Air Force problems than a high degree of resistance and demonstrate that they have the ability to coordinate many parts of an overall project.

"We must," he concluded, "recognize that the task of training highly qualified Air Force specialists is commensurate with the fast development of military science and technology requires our greater assistance. Solution of this problem by old methods does not yield the necessary results."



Kentucky Windage at 650 MPH?

"Kentucky windage" is fine for an offshore squirrel shooter at 60 yards. But how do you compute cross-wind allowance for high-speed jet aiming at fast-moving tank targets?

The completion of firing tables required for cross-wind cannon firing is typical of the complex problems facing modern weaponsmen. The special abilities of Thieblot Aircraft Company, a division of Vetro Corporation of America, in designing and manufacturing aircraft components and ordnance have made it a key member of the Army-Air Force teams working on this difficult ballistics problem.

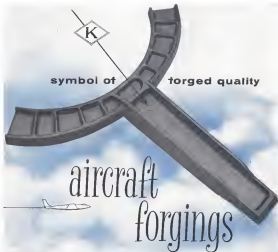
Thieblot's contribution was the design of a new ballistics data zone. Only a foot longer than conventional fighter zones, it carries a 20 mm cannon with mount independent of the aircraft motion, four high-speed cameras, radar, and electronic equipment. With auxiliary ground controls this equipment "feels" projectiles in time and speed. This leads to greater protection for bombers and other combat aircraft through more accurate tank fire.

The design of this ballistics data zone is one of many examples of Thieblot's capability in designing, developing and manufacturing aerodynamic systems. Other Thieblot projects include purge mass system for jet turbines, boundary layer control system, nose-wheel steering mechanism, weight reducing unit, escape reel for ditched aircraft, and C-46 modification kits.

Thieblot offers a complete engineering program to include engineering services, parts manufacturing, testing and production in a co-ordinated program that saves time and money.

THIEBLOT
AIRCRAFT COMPANY
DIVISION OF VETRO CORPORATION OF AMERICA

MUNICIPAL AIRPORT, WASHINGTON, D. C.
RESEARCH • DEVELOPMENT • ENGINEERING • PRODUCTION



symbol of forged quality

aircraft
forgings

BY KROPP

Forgings are vital parts in every plane that flies — and quality is the most important ingredient. The Kropp "symbol of quality" is the mark of an organization that has gained a reputation for excellence of products through competent and thorough engineering, outstanding craftsmanship and many years of forging experience. For low weight-to-strength ratios, uniformity of parts and maximum resistance to stress and strain, you need forgings — and where forgings can serve you, Kropp will serve you best. Our engineering and research departments as well as our complete manufacturing facilities for forging steel, titanium and special alloys are available to you. Send us your inquiry.



Kropp

FORGE COMPANY
CHICAGO, ILL. 60635

Missile Oven Creates High Temperatures

Cylindrical oven using thousands watt infrared lamps as a heat source, simulates temperatures encountered by Boeing Aerospace Co.'s F-105B missile in operation flight.

Tests are being conducted by the Planets Aerosol Division, Seattle, to determine high temperature behavior portion of the missile such as the after burner section can as a result of fire heat against the air.

Tests also indicate the effectiveness of the Boeing cooling system and of a layer of insulation inside the missile that is designed to retard the spread flow of missile skin heat.

Laboratory temperature testing is less expensive than gathering data from test flights and yields more information, according to Boeing.

Test Chamber Houses Nose Section of F-101

Altitude chamber big enough to house the nose section of a McDonnell F-101 is being used by Garrett Corp.'s Aircraft Manufacturing Division to simulate 50,000-ft. atmosphere.

Chamber was built so that compressor's rotor, housing and recuperator core parts could be tested in installed in place without flight testing.

On the rotor and recuperator components are under test. Company expects test facility, located in Phoenix, Ariz., will reduce lead time, improve thrust performance and permit testing to be done at a fraction of the \$10,000 or more as tests that require flight testing costs.

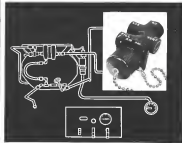
Two place F-101B is being tested. On the two "F" models are being at the present time, but place will soon be simulated in volume.

Computation Service Offered to Industry

Radio Woodbridge Corp. of Los Angeles has established a Computation Consulting and Service Bureau for business and industrial organizations. Bureau will be operated as part of the company's digital computing center. Consulting in computer applications and digital computing services, including mechanical analysis, programming and equipment rental will be some of the services offered.

Personnel fees for the preparation of programs for digital computers will be offered under a time and materials hourly type contract or a fixed price type contract.

PIONEERING IS OUR BUSINESS



AGAIN! ANOTHER BENDIX FIRST! NEW COMBINATION FILLER-BUILD UP VALVE SAVES SPACE! SAVES WEIGHT!

First, now combined in one unit, are the functions of a separate liquid oxygen filler valve and a separate build-up valve — the new Bendix F10-7. It reduces valve weight by 50%. It substantially cuts critical space requirements, and it minimizes possibility of human error by providing automatically the proper build-up position.

First... is the latest "First" — an added evidence of Bendix leadership in the pioneering of better products and advanced equipment in the liquid oxygen field.

Show the development of the new production liquid oxygen core meet as in this new F10-7. Bendix has commercially led in the creation of significant improvements.

For full details on the F10-7 write: PIONEER-CENTRAL DIVISION, 3000 W. 10TH AVENUE, COOK PRAIRIE, ILL. 60018.

West Coast Office, 117 S. Broadway, Burbank, Calif.
Eastern Sales & Service, South Westborough Division, 261 S. Main St., New York 10 117
Canadian Office, American Branch, Ltd., 330 University Ave., Montreal, Quebec.

Pioneer-Central Division



SPEED YOUR MISSILE
Precision Weldments in Stainless

FROM THE LEADING PRODUCER

Welding of all types on special steels and alloys can be contracted for confidently at the Jet Division.

Our experience in forming, welding, stress-relieving, and heat-treating titanium, high-alloy and stainless steels for jet engine components is available to you now for your missile programs. Deliveries will be prompt, quality will be to your required standards. Our engineering staff can also help you design and engineer weldments of all types.

Machining of weldments can also be done right in our own plant by people accustomed to closest tolerances, unusual alloys and designs, and aircraft-quality standards.

Let the Jet Division supplement your own overloaded missile production facilities. Capital investment will be eliminated, the search for qualified engineers and production people will be avoided. Delivery will be made to suit your production schedule. Write today for a Jet Division Sales Engineer to call.

SEND FOR BOOKLET AW-757

which describes the facilities and products of the Jet Division in detail, shows how you can use these facilities to best advantage.



PROGRAM WITH
and High-Alloy Steels and Titanium
OF JET-ENGINE PARTS



JET DIVISION
Thompson Products, Inc.
CLEVELAND 17, OHIO





Automatic Talos Missile Evaluated in 'Desert Ship'

Talos shipboard launchers are shown above being loaded for firing. Ground operations for Talos in its right. Missiles are automatically hoisted out from concrete storage crills at sea, transferred to launcher



Operations building (foreground) Missiles assembly, radar fire control system. Assembly building, launch pits are behind

KIRKDON WEEK, October 28, 1972



"Missiles are a different breed of animal!"

You hear that statement often these days, in engineers and production men shift their thinking to meet the daunting missile age.

For the past 10 years "ultra-reliability" has been the byword at Electro Tec Corporation.

We have achieved it by developing unique designs and methods that now place us in a leading position to meet the even greater emphasis placed upon reliability by the stringent requirements of missile control and guidance systems.

It takes no more to have the assistance of Electro Tec's "ultra-reliability"—and it is rooted in demonstrable scientific facts.

Take our slip ring assemblies, for example.



Over twelve of 26 ring slip ring assembly showing exclusive "Symmetrical Interference" (patented U.S. Patent)

1 Mechanical stability under high temperatures, shock and vibration, and greater strength are the result of symmetrical construction throughout, and the use of a hardened center wire. (See Christian at left)

2 Ultra-reliable electrical performance, lower noise levels, more uniform wear because the exclusive Electro Tec process permits the use of pure 24K gold and fine silver instead of alloys.

3 "Molecular bond" of ring to wire assures positive, permanent connections under high temperatures, shock and vibration.

These are the points of Electro Tec superiority that add up to "ultra-reliability" in the air and on the shelf—now . . . or three years from now! Electro Tec Sales Engineers are available in all parts of the country. Write to,



ELECTRO TEC CORP.

2400 Westwood, N. E.

Products of Precision Craftsmanship



"Ultra-reliability" for the missile age.

Box 5, P.O. 130100 The Greening, Ga.

Next logical step after Vanguard?

THE FAR SIDE OF THE MOON

We don't know what we'll find there—it's the side of the moon we never see.

Yet after Project Vanguard, a flight to the moon—and a look at its far side—would be the next logical step in our penetration of outer space.

To make this step, we must solve the problem of guidance. How do you send a rocket out and around the moon and then back to earth?

The most promising method to date would include the use of inertial guidance systems such as Honeywell has helped pioneer and develop.

Honeywell's inertial guidance systems consist of ultra-precise gyros, accelerometers, computers and associated electronics that enable a missile to know where it is and how to reach its destination by "remembering" where it started from and where it wants to go. It provides guidance far beyond the reach of radio or radar.

Pioneering in the research, design and production of airborne controls has given Honeywell the advanced technical competence you can rely upon in the solution of your airborne control problems. Contact Minneapolis-Honeywell Aerospace Division, 2000 Ridgeway Road, Minneapolis 55, for details on valuable assistance—from original planning to final production.

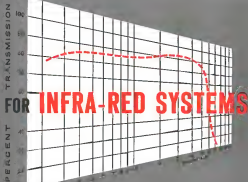


Actual photo of the Honeywell space reference system designed for Project Vanguard. This Honeywell inertial type guidance system will guide stages one and two of the Martin-designed earth-orbit launch vehicles. Third stages will then not leave to position satellites in their orbits.

Honeywell

 *Aeromaterial Division*





SPECIFY **LINDE** Sapphire

LINDE Sapphire is ...

Hard—Moh 9
Transparent, single crystal, pure
sapphire sapphire
Nonporous—0% porosity
Early sealed to metals and ceramics
Proved competitively with
insulated materials

LINDE Sapphire has ...

Strength at elevated temperatures
High melting point—2040° C.
Excellent IR transmission
at high temperatures
(above 500° C.)

LINDE Sapphire is available as ...

Windows
Domes
Bells and tubes
Special shapes—to order

For more information about LINDE Sapphire, write "Crystals Dept., AW-14," LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: LINDE COMPANY, Division of Union Carbide Canada Limited.

Linde

**UNION
CARBIDE**

ENGINEERS AND SCIENTISTS interested in working in Synthetic Crystal Sales & Development, contact Mr. E. E. Bennett, Linde Company, 30 E. 42nd St., New York 17, N. Y.

The name "Linde" and "Union Carbide" are registered trademarks of Union Carbide Corporation.

PRODUCTION BRIEFING

North American Aviation, Inc., Calhoun, Ga., recently installed a table to hold wing panels for precision drilling. It consists of two aluminum rods and



ings weighing up to 7,500 lb. and used to construct the largest and slowest moving, ever produced. The 120-ton machine is 25 ft. long, 170 in. wide and 16 in. deep.

New Eastman 910 adhesive is used to be so strong that one drop placed between two 7-in. steel rods with eye bolts will support 65,000 lb. after it has set in 30 min., just long put into production by Eastman General Products, Inc., a subsidiary of Eastman Kodak Co. The new adhesive is an exothermic adhesive modified with a



disinfecting agent and plasticizer. When the adhesive is poured over a thin film between two surfaces, a polymerizing reaction takes place which results in a relatively rigid set. General claims that careful use of the versatile adhesive which will bond metals, rubbers and plastics in a few seconds strength rapidly over 212°F.

Pacific Aerospace will use 250 sq. ft. of the 100 lb. adhesive, which will



facts about Flexflyte® that will help you solve your aircraft ducting problems

What is Flexflyte?

A lightweight, reinforced ducting made of a spring steel wire helix covered with coated fiber glass or a cotton fabric and bound with a fiber glass cord.

What are its applications?

Flexflyte is designed for use with venting, de-icing, de-icing, de-icing and hydraulic systems.

How flexible is Flexflyte?

It will take tight turns at any point up to 180° without buckling. No elbows or fittings are required.

What are its temperature ranges?

From minus 130°F. to plus 650°F.

What about Flexflyte's resistance to abrasion?

It is highly resistant to abrasion, especially when coated with FT-506 which has more than 200 times the abrasion resistance of any kind of its type and weight.

Is it flame resistant?

Flexflyte has exceptionally high flame resistance and will not support combustion.

What pressures will Flexflyte handle?

Internal working pressures up to 70 psi and external working pressures up to 15 psi, depending on type.

What about installation?

Flexflyte is quickly, easily installed around corners and equipment parts by means of metal clamps. It is also available with special clamping or reducing ends, either cylindrical, rectangular or polyhedral.

Can Flexflyte be engineered for unusual applications?

Yes, in many special shapes, fabrics, coatings, connections, lengths and diameters. Our special fabricating Department, working with automated machinery, is prepared to meet any requirement for silicone ducting.

How can I make sure that Flexflyte will solve my problems?

Write us, outlining your requirements. Our engineers will be glad to put their experience to work for you. Write Dept. 210.

Represented nationally by Aero Engineering Co. and Knapley Co., and by Associated Industries in Seattle, Washington.

Flexible Tubing

CORPORATION

GULFORD, CONNECTICUT • 105 ANGELES 44, CALIFORNIA



HEAVY HAULING—Big Sikorsky S-56-type helicopter (Army H-37) has demonstrated many times carrying troops, supplies, vehicles and weapons. A big H-37, above,

carries a heavy Army truck during recent demonstrations for The Army Aviation Board. H-37s are undergoing rigorous field testing at Ft. Rucker, Alabama.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS



TURBINE-POWERED S-55—This turbine-powered Sikorsky S-55 has been flying since the beginning of the year. Built under an experimental Navy program, the test bed is equipped with two General Electric T-58 gas turbines, each rated at more than 1000 hp. Performance is classified



SIKORSKYS TO CHILE—With the delivery of four S-55 helicopters, Chile becomes the 32nd nation to operate Sikorsky helicopters. The Chilean Air Force will fly these versatile helicopters up air-sea rescue duty, service in which the S-55 has been conspicuously successful.



HELICOPTER HISTORY



100,000th HELICOPTER PASSENGER

On June 25, 1957, Baron Herve de Gaudon, right, Helgoland Ambassador to West Germany, flew from Bremen to Bonn on a Sikorsky S-55 as S.A.I.C.'s 100,000th helicopter passenger. At far side, above, is S.A.I.C.'s president, Mr. William Devereux. Not long after, New York Airways flew its 100,000th helicopter passenger. Both have begun scheduled passenger service with Sikorsky S-55s, and have since been equipped with S-55s.

HURRICANE WARNING—A day ahead of Hurricane "Audrey," Sikorsky helicopters from the U.S. Coast Guard detachment at New Orleans started warnings to fishing boats, escape and isolated settlements in the lower Mississippi delta region and around New Orleans. After the hurricane struck the Louisiana coast farther west, the helicopters were assigned to help in the rescue and evacuation work along with Sikorsky helicopters from military services and oil companies. Hundreds of people were flown to safety.



SIKORSKY AIRCRAFT

BRADFORD, CONNECTICUT
One of the Divisions of United Aircraft Corporation



S-58s Land Marines

Westco helicopters of Marine Aircraft Group 26 unload troops on deck of USS Lake Champlain at Operation Deep Water landing. Operations included seven landings of Turkish coast as test of NATO defenses.



AFTER UNLOADING (photo above) helicopters from 2d Marine Aircraft Wing, Cherry Point, N. C., others (below) for more troops



These MODERN Recirculating Ball Units can help you...

SOLVE ACTUATION and TORQUE PROBLEMS



Saginaw h/b Screws guaranteed 90% efficient—offer 6 major advantages for designers

Saginaw h/b Spines average 40 times lower friction coefficient than sliding spines

Available in custom machined and commercial rolled thread types—have been built from 3 inches to 39 1/2 inch long—5/8 to 10 inches diameter.

Transmit or receive high torque loads for more efficiently—have been built from 3 inches to 10 feet long—5/8 inch to 6 inches in diameter.



High precision ball bearings like spines are a better ball-bearing than sliding spines. They are built through solid, hardened, polished by computer methods to finish, and cooling rate.



At end of life, one or more balls are pushed back into position. This allows the unit to be used as long as it is in the position of use. It is not a problem when balls are pushed back into position.



The Saginaw h/b Spine is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads.



The end balls are built to receive the stresses of bearing loads. They are built to receive the stresses of bearing loads. They are built to receive the stresses of bearing loads.

- TOTAL POWER SAVINGS:** With improvement of design of S-58, the ball unit is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads.
- SPINNING ADVANTAGE:** The ball unit is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads.
- REPAIR ADVANTAGE:** The ball unit is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads.
- REPAIR ADVANTAGE:** The ball unit is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads. It is built to receive the stresses of bearing loads.

This revolutionary new kind of spine offers the same basic principle pioneered by Saginaw in the ball-bearing series. It provides one engineering design over before mentioned—intensity into action the "impossible" in any application where volume length must change under longer load, the Saginaw h/b Spine offers greatly increased. Each, less wear, longer life, more dependable operation. It can be used with integral gears, clutch dogs, bearing and sprocket sets or it made choice of other attachments for use with electric, hydraulic or pneumatic units. No convert push pull or rotary motion, ball unit can operate with very high loads, ranging from 200 to 1000 lb.

SEND TODAY FOR FREE 1957 ENGINEERING DATA BOOK...

or ask for sample in Saginaw's Product Design File



Saginaw
b/b
Screws and Spines

SAGINAW STEEL TO YOUR DESIGN OF ACTUATION, TORSION
WORLD'S LARGEST PRODUCER OF BALL BEARING TENSORS AND SPINES

Saginaw Bearing Gear Division
General Motors Corporation
B's Screw and Spine Division
Box 48, Saginaw, Michigan

Please send me engineering data book on Saginaw h/b Screws and Spines to:

Name

Company

Address

City State

Turbojets Are Theoretically Capable of Mach 4 Speeds

By J. S. Batz, Jr.

Cleveland, Ohio—A summary of the present state of turbojet engines at Mach 4 will give a more graphic illustration in the design of future aircraft than has been expected.

Withholding the chance of powerplants will make it soon to estimate 2,500 mph aircraft for a decade hence, requiring relatively great gains, as speed, in some other specific performance.

National Academy Committee for Aeronautics scientists at the Lewis Flight Propulsion Laboratory have been told that current aerodynamic and combustion knowledge indicates that Mach 4 turbojets are feasible. This point out, however, that practical construction of such engines will require a major research and development effort mainly because of the high temperature performance required of engine components. Mach 2.5 is about the upper limit for present-day turbine engines.

Types of Powerplants

If the Mach 4 turbojet is developed, the powerplants available at that speed will also include turbojets, ramjets, dual-cycle engines, and various combinations of these. The turbojet would retain the advantage it has today. It would be the simplest, least complicated engine configuration capable of delivering continuous power in an aircraft through its entire flight. Each of the other engine types will undoubtedly be superior in the speed range for certain missions.

NACA sees Mach 4 as the possible ultimate speed of the turbojet. Research will have to reflect data advantages along supersonic regimes above that speed even though they cannot function during landing, takeoff and cruise climb.

Critical problem of selecting a powerplant involves more interdependent factors concerning the aerodynamic and structural design of the aircraft in flight as the engine. Since it is impossible to separate these interdependent engine studies at Lewis Laboratory inside the neutral interaction of the powerplant installation on the structure.

Hypothetical Case

A preliminary example of such a study was presented during a recent Transonic Symposium at the Lewis Laboratory. Thrust requirements of a Mach 4 turbojet over its whole speed range were determined by considering the drag of a hypothetical aircraft representing the most advanced aerodynamic and structural thinking. The transonic drag coefficient for a speed of Mach 4 at about 85,000 ft. Adequate thrust was stated to be 15% more than the drag at cruise speed.

This means good acceleration throughout the speed range. With a smaller thrust engine, excessive amounts of fuel would be consumed during acceleration and the aircraft's range would be severely reduced.

Main line of this example study was to show the importance of the engine's inlet and exhaust nozzle design. The conclusion is that such systems must have variable geometry, if the engine is to deliver adequate thrust during the whole flight. Even if the best engine is capable of delivering much more thrust than the design requirement, it can be rendered inoperative by a poor installation. Thrust losses at the inlet and exhaust nozzles, from pressure losses in the inlet and exhaust ducts due to inlet flow conditions and shock in over expansion losses in the exhaust nozzle.

Example study is illustrated on pages 56-57. Upper figure shows a fixed

geometry installation meeting the design conditions of Mach 4 speed at 85,000 ft. The thrust deficiency around Mach 2, although it will bring adverse thrust up to the prescribed 15% increase over aircraft drag.

Inadequate Thrust Cause

The inadequate thrust around Mach 2 is generally due to two things: • High drag caused by an up-bow around inlet. Engine requires about 60% less air at Mach 2 than it does at Mach 4. Thus air is deflected around inlet.

• Overexpansion of air in exhaust jet, causing strong shock waves which slow down jet velocity. Exit area of nozzle, which is correct for Mach 4, is too large for Mach 2.



INSTALLATION shows a typical of inlet and exhaust systems for Mach 4 turbojets. It has fixed geometry designed for Mach 4, but as develops power at the intermediate speeds that typical engine would not be able to exceed Mach 1.5 (right).



DRAWING above shows flow conditions at Mach 2 with a variable geometry exhaust nozzle. Large intake expansion ratio is not needed below Mach 2. Nozzle changes allow air not sufficient to cause the intermediate speed (right).



FURTHER ADDITION of a variable geometry inlet for the installation adequate thrust over the entire speed range. Inlet shows here is of the external expansion type. Number of possible solutions to the variable geometry problem are being investigated.

The next figure shows that using a variable geometry nozzle will not correct the thrust deficiency around Mach 2, although it will bring adverse thrust up to the prescribed 15% increase over aircraft drag.

When variable geometry is added to the inlet system the engine and its installation are able to produce the necessary thrust over the whole speed range, as shown in the lower figure.

Variable geometry mechanism of the inlet system would have to include means of varying the angle of the ramp ahead of the inlet as well as an efficient bypass to bleed excess air in the duct to the outside structure.

Inlet Function

Inlet system shown in this example is but one of those currently being investigated by NACA, after research agencies and aircraft manufacturers

friction of these inlet systems is to draw and compress air entering the air duct. Air should enter the turbojet's compressor at less than half the speed of sound.

Inlet inlet system accomplishes this difference with a maximum loss of total pressure in the air stream and with minimum drag. Both of these losses tend to decrease the effective thrust of the engine.

There are generally two methods for slowing a supersonic air stream. One is an external deflection system and the other internal. The one used in the present example was an external system. This slows the supersonic flow to a low supersonic Mach number by restricting the air stream and then diffuses it to release speed by means of a normal shock wave.

Internal system generally uses a series of curved flow cones if the inlet is internal which create oblique shock waves to slow the air, then the normal shock is located some distance from the inlet.

in the inlet cone. Air velocity becomes subsonic across this shock and enters the duct at less than Mach 1.

Internal System

With the internal system, an internal shock at supersonic velocity. The duct contracts to a throat where normal shock waves are the strong between subsonic. Duct then expands to slow the subsonic stream.

Exhaust gases with the internal system when the inlet is too large and engine is too takes into the duct than the engine needs. That excess air then spills around the inlet causing a large drag. If the inlet area is too small, the engine sucks the normal shock at the inlet back down the duct causing a decrease in flow, decrease in air pressure in the inlet area. Very accurate and sensitive controls are needed to keep the shock pattern and inlet area adjusted to that neither of these two excessive losses will occur.

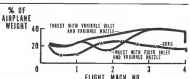
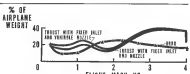
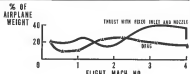
Exhaust with internal system enters around making the normal shock wave start at the inlet and move down the duct to the throat. This movement of the normal shock depends on the ratio of the inlet area to the throat area. The pressure recovery, also depends on the area ratio. Unfortunately, a maximum pressure loss and high duct efficiency demands with a small throat area in relation to the inlet area that the normal shock won't move down the duct to the throat. It stands out in front of the duct, creating a large drag. If the throat is opened up to allow the normal shock to move back to the throat, there is too low pressure must be accepted. This type of internal system is also very sensitive to back pressure. If the engine surges or its air flow creates a sudden back pressure, the shock may pop out of the duct. Striking the shock back up the duct requires the proper combination of Mach number, back pressure, etc. Sometimes a variable flow is set up that is difficult to stop.

Corrections Devised

These problems of internal diffusers have been largely corrected. The fundamental aerodynamic portion of the diffusers have been perfected, making the ducts much easier to start and much less susceptible to back pressure.

Variable inlet thereby make the internal duct capable of operating over a wide Mach number range. Both internal and external systems are being developed and have their advantages.

In addition to having a more elaborate lines of variable inlet and exhaust nozzles than current turbojets, the Mach 4 super jet also have a different design in almost every major component. The compressor will have about three stages instead of 12 to 15 that are no





DOUBLE your welding speed with **PcH** Iron-Powder Electrodes

That's right! You can cut welding time in half with **PcH** Iron-Powder Electrodes. The high thermal energy of these special coating speeds deposition, enabling your operators to produce smooth, x-ray quality welds by simply dragging the rod. Spatter is exceptionally low and welds are practically self-cleaning. . . possess high strength with greater impact qualities at low temperatures.

These high-speed electrodes are also available with Iron-Powder Low-Hydrogen coatings. As a result, you can get ultra-fast welding of problem steels with little or no pre-heat. The superb quality of the chemical coating prevents underbead cracking

and porosity . . . eliminates costly rework. Their extraordinary mechanical properties make them ideal for welding heavy sections that are subject to severe shock and abuse. What's more, they cost less than conventional high-alloy electrodes.

For types and sizes, send for Bulletin R-39, Write Dept. 38534, Harnischfeger Corp., Milwaukee 48, Wisconsin.

HARNISCHFEGER

PcH WELDERS • ELECTRODES • POSITIONERS
MILWAUKEE 48, WISCONSIN



NACA altitudinal test model of Mach 4 turbojet. Model has true type variable geometry inlet, three stage compressor, very short combustion chamber and afterburner, and variable area duct.

some current engines. This is possible because pressure loss per stage has been tamed and because much of the compression is accomplished in the inlet duct instead of the compressor. Better luck as well as improved combustion design will greatly shorten combustion chamber and afterburner.

Temperature Comparison

NACA predictions of the temperature within the Mach 4 turbojet show into some of the development problems facing the engine. For comparison, the temperatures in a typical Mach 2 engine will be given first.

- Turbine inlet—1,650°
- Turbine outlet—1,100°
- Discharge exhaust—1,100°

For the Mach 4 turbojet these same temperatures will roughly be:

- Turbine inlet—1,650°
- Turbine outlet—1,000°
- Discharge exhaust—1,000°
- Compressor inlet—1,700°
- Compressor outlet—1,700°
- Exhaust to combustor—1,500°

Due to the Mach 4 turbojet these same temperatures will roughly be:

- Turbine inlet—1,650°
- Turbine outlet—1,000°
- Discharge exhaust—1,000°
- Compressor inlet—1,700°
- Compressor outlet—1,700°
- Exhaust to combustor—1,500°

Most serious temperature problems will be encountered in the compressor and the main engine bearings and seals. The compressor will require the use of the most advanced alloys now used in turbines to withstand the combination of high temperatures and high stress.

The turbine on the Mach 4 engine is expected to be the turbine compressor of the Mach 2 engine because the stresses in the turbine have been used to stretch the analytical capabilities of the compressor.

Environmental temperatures of heat and stress in the Mach 4 engine will be the most severe of such environments because of the heating of the air as well as temperatures within the core.

NACA studies indicate that the inlet will be definitely superior to the best inlet used on Mach 4. This conclusion is based on the fact that actual Mach 3 turbine begins to exhibit water pressure from the inlet than the compressor puts in. This detrimental effect of the turbine-compressor inlet on the third stream is well speed. The inlet stream doesn't have the bending and is more efficient about Mach 3.

In terms of a typical engine reaction flow, the inlet is still competitive up to Mach 3. Using simple, the air inlet coming at Mach 4 can be much smaller than an aircraft with similar range using turbojets. However, the smaller inlet powered plane would need some sort of boost arrangement to take off. The weight of this booster

would bring the total weight of the aircraft up to that of a turbojet engine, if such were used in the front.

Solid Fuel Engines Increase Reliability

Missiles powered with solid fuel rocket engines are setting new standards for reliability according to two studies by manufacturers.

Lockheed reports that its X-17 three stage rocket vehicles have flown successfully in over 90% of their firings.

Thiokol Chemical Corp., which developed the first large solid propellant engine shown in our leading figure. Thiokol reports that large long term, high velocity missiles with Thiokol engines have completed their flights 97.5% of the time.

These engines were all of the same general size or larger than the one in the RVA-10 of the Hercules missile program. This missile proved the feasibility of large solid fuel motors. The first stage motor of the X-17 is of this same general size.

About 130 of these large engines have been fired to date. Ninety were static firings and the rest flight tests. Only one flight test failure was partially attributed to the engine.

These high records for reliability are in sharp contrast to the World War II figure of about 30% for all missiles and is indicative of the progress which has been made.

Titan Subcontract Canceled by Martin

Los Angeles—Martin Co. has cancelled a contract with Associated Missile Products Corp. of Pomona, Calif., for general control instrumentation for the Titan intercontinental ballistic missile in production at Martin's Denver plant.

The contract total was \$71 million but it had been largely completed. Martin spokesman said the termination was as a result of an effort to get costs down.

W. L. Connelley, Denver general manager for Associated Missile, said the contract still needed the job for more than 100 employees in Denver and another 100 in Pomona would be jobless as a result.

Martin said it would continue the general instrumentation work in the direct responsibility of the Martin firm. Associated Missile started to work here last January.

Martin said the action did not represent an setback at its plant. "Martin will be able to do the work. Associated has been doing," a company official said.



George A. Philpott, manager, with General Electric's advanced constant-speed drive (left) and 25-KVA hydraulic retransmission drive

and generator package (right). 1175-hp, 60-KVA turboset (power turbine and Malyard turbine on a common shaft).

How to Choose the Right Constant-Speed Drive

General Electric engineer outlines method to help determine which constant-speed drive—hydraulic or air-turbine—best suits requirements of particular aircraft

By George A. Philpott, Manager

Systems Engineering, Aircraft Auxiliary Turbine Dept., General Electric Company

Providing a source of adequate, precisely controlled power—often constant aircraft performance priority—is a challenge to the aircraft designer. Electrical loads continue to increase; jet surfaces require lighter, sturdier, simpler to operate power systems with automatic fault protection.

Today, engineers are recognizing the increasing importance of the power drives, and looking closely at the comparative advantages of hydraulic and air turbine drives.

Both hydraulic and electric drives are reliable, efficient.

In general, there are few differences in performance between the two types of drives. Both hydraulic and air-turbine drives offer aircraft a reliable source of constant-speed power. To get optimum performance from a particular source, however, the relative merits of each drive system must be carefully matched to the requirements of the plane—its mission and power plant characteristics, temperature requirements, space and weight



LOCATION IS ONE CONSIDERATION. Hydraulic drives require constant direct or indirect access to water pool with generator (top). Air-turbine drives can be located in engine or in wing or fuselage area (bottom).

limitations, and reliability.

To help aircraft designers select the drive system that will give their plane the optimum performance, General Electric's Aircraft Auxiliary Turbine Department offers assistance in each of the following steps in the selection process:

1. Establish alternate drive system configurations.

Initial drive system layouts depend upon a analysis of plane configuration, power plant, emergency power needs, and mission including starting and ground handling. . . . feedback appears only in the aircraft design stage.

At General Electric alternate configurations will be prepared by a group of engineers with broad experience in the design and application of both types of drives, plus a knowledge of electrical system constraints and protection.

2. Study boundary conditions and size constraints.

Drive system boundary conditions include the input from the power plant, characteristics of the power distribution system, loads into which output is fed, and environmental conditions with particular reference to heat dissipation and cooling. The system analysis includes a thorough evaluation of these boundary conditions and their effect on the design of necessary power system components. Overload and fault clearing loads exposed

by the electrical system, for example, must be satisfied by a drive which will deliver this output under all required engine operating conditions.

Using as the IBM 704 computer, General Electric engineers determine maximum fault torques in terms of after-burner sequence capacitance and type of modulation system. This simplifies the problem of determining the best size components between satisfactory voltage performance with unbalanced phase loading and fault current capability on the one hand and drive and engine loads on the other.

3. Analyze weight penalty of each drive.

After the several system configurations have been defined, total weight penalty—the system's installed weight plus weight of fuel necessary to compensate for power extraction plus drag due to the system—then becomes an important comparison basis for drive selection.

To assist the aircraft manufacturer in this phase of the selection process, General Electric systems engineers team up with computer technicians to deliver facts and figures on both drive systems. Required, necessary performance, available in mission profile, load demands, airframe and engine performance, and weight of system components are some of the factors which may be programmed into the IBM 704 electronic "brain."

4. Consider special requirements.

Choice of a system entails beyond quantitative investigation. Special considerations—installation and maintenance, unusual operating requirements, number of power plants and drives, effect of wheel starting and air conditioning systems—must be studied carefully. Operating advantages obtainable from each type of system must be evaluated and matched with the particular application before the best drive can be chosen.

... and after the right drive is chosen. . . . Developing the prototype, and finalizing it into mass production models, are tasks that will be based experience and modern facilities.

Today, at General Electric, constant speed drive engineering and development facilities—10 test cells, 60,000 sq. ft. of development floor space, 500,000 sq. ft. of production floor space—are installed "under one roof" at O.E.'s Lynn, Mass., plant. This integration combines technical know-how and product versatility.

and adds up to one more reason why General Electric is qualified to help assure that the right choice is made, and the right drive produced.

For more information about specific products of the Aircraft Auxiliary Turbine Dept., check with your nearest D-E Aviation & Defense Information Sales Office, General Electric Company, Schenectady 5, N. Y.

201

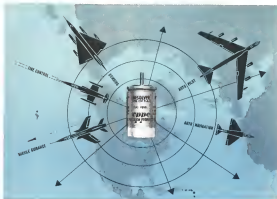


ANALYSIS performed in early design stages by General Electric engineers is later programmed to IBM 704 computer to help systems select power drive system that best meets requirements of aircraft.



QUALITY STANDARDS of drive components are assured by modern methods and equipment used throughout half-million sq. ft. of production floor space at O.E.'s Aircraft Auxiliary Turbine Dept.

GENERAL  ELECTRIC



IN AVIONIC EQUIPMENT, WHY LOAD ON EXTRA WEIGHT?

use Clifton Precision Size 8 Synchros

WEIGHT 32 GRAMS

| SERIES | PART NO. | VOLTAGE TO PERMITS | | | | | VOLTAGE TO PERMITS | | | | | S. S. WINDING | | | | | SIGNALS | | | | |
|-------------|----------|--------------------|----|----|----|----|--------------------|----|----|----|----|---------------|----|----|----|----|---------|----|----|----|----|
| | | 10 | 20 | 30 | 40 | 50 | 10 | 20 | 30 | 40 | 50 | 10 | 20 | 30 | 40 | 50 | 10 | 20 | 30 | 40 | 50 |
| 1000 Series | 1000-101 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-102 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-103 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-104 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-105 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-106 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-107 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-108 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-109 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Series | 1000-110 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |

1000-101 TO 1000-110, 1000-111 TO 1000-120
CLIFTON PRECISION PRODUCTS CO. INC.

eppe
Clifton Heights, Pa.



PLASTIC bubble protects camera mounted on nose of C-130 DC-3 flying laboratory



MONITOR shows picture of subsonic leading gear in down position. Camera could be used to estimate amount of touchdowns in cross wind landing

TV May Provide Airliner Inspection

By James A. Fucci

New York—Use of closed circuit television for night inspection by pilots of leading gear, wing and tail assemblies is being studied by at least one major airline. If not so found to be justifiable, use could be extended to include individual inspection of engines and control surfaces from the cockpit.

Equipment proposed for this use is rugged 400 cycle camera and monitor developed by General Precision Laboratory, Inc., Flemington, N. Y., for military use under extreme environmental conditions. General Precision has installed and demonstrated the equipment in a DC-3 flying laboratory equipped with cameras to show how the above functions could be presented on

a single monitor with selective switching.

Present study is being conducted by American Airlines which is considering an installation of two cameras on an experimental bus in one of the ten Cessnas, usually withdrawn from service. Monitoring and functions of the camera would be as follows:

- Vertical tail: Forward looking camera mounted on the vertical tail fin might solve the widespread problem of spotting an obstacle on the Lockheed Electra and Boeing 707. Aerial view point will not have full maneuverability of wings either from cockpit or the cabin as the Electra and 707 can be maneuvered with difficulty in the 707.

- Tail dual: Camera mounted on the tail fin and looking forward could as-

sert the pilot in minimizing stress on the landing gear assembly in crosswind landings by showing vertical distance to touchdown. American feels that reduced landings necessitated by the use of professional runway increases maintenance cost on landing gear structures, fuselage and tail. Possible solution would be for the camera to enable the pilot to judge just before touchdown the moment at which to take his aircraft out of a wingover or crabbed attitude.

DC-3 being used by General Precision for demonstration of its closed circuit TV equipment contains four cameras whose pictures can be shown on color monitors accessible to selective switching. Camera perhaps on the nose shows position of air-



NOSE camera inside bubble, showing help in controlling roll and focus settings



CAMERA viewing vertical tail fin and port horizontal stabilizer is shown mounted in this plastic bubble just aft of passenger loading door



DOES YOUR INTERCOM HAVE "FAT" BETWEEN THE EARS?

To meet the concepts of today's and tomorrow's supersonic jet aircraft, problems, intercoms have undergone extensive systems evaluations to remove the "fat".

A case in point: Andrea research engineers have devised a material improvement in intercom systems embodying all factors . . . weight, reliability, form factor, simplicity, performance . . . for the military establishment. This is just one example of how Andrea Radio Corp., with some of the best brains and facilities

in the industry, can augment your organization in solving a wide range of electronic problems.

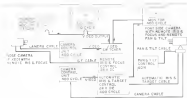
Imagination, ingenuity, industry—that's the "bible" at Andrea, a company known to all departments of defense for consistent top level quality performance in engineering and production of advanced electronic design.

Andrea has the resources and manpower to help you solve your defense electronic problems. Simply write us your intercom to:

SYSTEMS DIVISION

Andrea RADIO CORP.
Long Island City 1, N. Y.

A Pioneer Name in Electronics—Research, Development, Production—Weapon Systems, Communications, Navigation, Counter Measures, Benchmark Applications.



BLOCK DIAGRAM of a two-camera, two-camera infrared closed circuit television system such as is on GFL's DC-3 "Flying Monitors."

board landing gear, also calls in judging touchdowns. Camera is enclosed within a protective plastic housing and mounted fixed to the skin of the fuselage.

• **Air footage.** Second camera is mounted on the upper portion of the large pit out of the passenger door. This camera provides close-up pictures of the vertical fin and port horizontal stabilizer, including winging equipment. Camera is mounted in a clear plastic bubble.

• **Collar.** One camera is mounted adjacent to one of the collar ports to demonstrate one of the easiest for night ground surveillance.

• **Belly.** Fourth camera is mounted in the belly, directed straight down

through a clear circular port. In this position, it is used to view chock points in tests and demonstrations of General Precision's self-contained navigation system.

Further Work

General Precision is exploring the possibility of using the weather radar scope currently in the cockpit of non-commercial aircraft for presentation of its TV picture. This pilot would then be able to switch his scope from radar to television at his convenience. Infrared camera to date are that the problems are too difficult to be solved in an commercially acceptable fashion.

Present problem is that a radar scope

is designed for rotating scan and constantly rapid range decay while television requires horizontal scan with slow range decay. As an alternative solution, General Precision is considering development of a small 2 in. scope vision slot that would minimize problems of redistribution in already overcrowded cockpits.

Developed for use under extreme environmental conditions, General Precision's ruggedized camera presently is in use for flight testing, rocket and jet test stands, wind tunnels, and military ground and air vehicles.

Features of the camera that GFL says make it attractive for this application include:

- Both optical lenses and the aperture could be controlled from the cockpit.
- Camera will operate satisfactorily under 250 shocks, 100% humidity, ambient noise levels above 175 db, under temperatures between -50 and +80C, and at altitudes up to 100,000 ft.
- Weight of camera, 6.5 lb., control unit, 3.5 lb.
- Resolution of 500 lines for 525 line system, 60 fields/second.

Monitor System

Although the camera can be used with conventional industrial closed circuit monitors (modified to operate from aircraft's 440 cycle airborne power supply), General Precision anticipates use of a special 7 in. airborne monitor designed originally for the Air Force that is designed to accept MIL spec,



CAA Tests Control Equipment

Combined radar, aircraft identification and warning board (RTI) can be displayed in high-contrast light on its superimposed television picture of auto-terrain working table on radar screen. Procedures in French development called SPAN-AD, being tested in CAA's Testbed Development Center at Toulouse, CAA is now testing automatic data processing of air traffic control information. Controls is assessing flight plan by telephone and entering information on printed card.

behind these panels



smaller,
lighter, cooler
Westinghouse
transformers
for each function
of every
aircraft A-C system

Constant, dependable power is a must for flying instruments, engines, radars, window heating, and other functions in commercial and military aircraft A-C systems. Combining full power ratings with minimum size and weight, the Westinghouse aircraft power transformer provides efficient output at this distribution voltage.

Reduced size and weight is achieved by a combination of Class H insulation and continuously improved Westinghouse grain-oriented Hipercol® steel for cores.

Easier installation and maintenance are assured by milled terminal boards and covers. This feature provides an additional weight reduction, too.

Peak cooling efficiency results from the open type construction, which also eliminates wicking treatments and filling compounds.

This transformer meets all environmental, overload, regulation and efficiency requirements of Air Force Specification MIL-T-5025, as well as the most rigid military requirements. It is rated at:

1½ kw, 3 phase, 360-420 cps, 280-315 volts, full load.
Contact your Westinghouse representative, or write Westinghouse Electric Corporation, Specialty Transformer Department, P. O. Box 231, Greenville, Pennsylvania 17041

YOU CAN BE SURE... IF IT'S

Westinghouse



is shock mounted, and uses a 7 in. circular screen. Deadweight would be cost of about \$4,000 compared with about \$180 for the industrial type.

The 7 in. screen machine has a resolution of 150 lines, weighs 42 lb, without mounting, and has a specified maximum life of 1,000 hr. at 50°C.

000001 FILTER CENTER 00000

►Diode Converter: With Gas-Semiconductor diode-type, frequency converter, which also provides useful amplification, has been developed by Bell Telephone Laboratories. Most promising results to date have been achieved with upconverters, in which gold-

plated germanium diode converts 75 mc to 6,000 mc, providing gain as high as 6 db with "adequate bandwidth." Up converter does not supply in correct direction, can be made with large active areas to increase power handling capacity. Conversion gain as high as 45 db have been obtained with diodes when diode down-conversion. Down converters have relatively poor isolation between input and output, but Bell believes that use of nonreciprocal ferrite devices may get around this disadvantage.

►Silicon Transistor Prices Drop: Seven improvements has cut prices of an silicon transistors by as much as 12%, and prices of silicon plan diodes by 35%. This is the second silicon transistor

price cut made by the company during 1967.

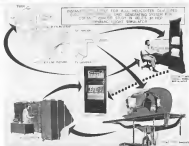
►AGCA With Voice-Galileo: A flight testing new version of its automatic GCA (AGCA) which uses voice data link instead of pulse-coded data link, opening way to its use by military and civil aircraft equipped only with conventional communications systems. First flight tests, made Sept. 20, is portly were "very successful."

►CAA Buys More In Route Releaser: Aircraft Releaser System has placed \$4.1 million contract with Raytheon for low noise long range traffic control radar plus Argonne (high power microwave amplifier) to boost range of 10 of 25 en route radar.



Analog Device For Helicopters

Contact analog device which displays in artificial picture of the ground to aid helicopter pilots in day, night all weather flying is being developed by Bell Helicopter Corp. Bell has helicopter part of the Army-Navy Instrument Program (ANIP) under a contract with the Office of Naval Research (ANM Oct. 22, p. 14). Pictures show helicopter flight simulator being developed in cooperation with the contact analog display. Object is to enable pilot with only 20 hours flight instruction to fly a helicopter under all weather conditions.



THE CONVAIR 880 IS THE

LATEST JET AIRLINER



TO USE CLEVELAND

PNEUMATIC GEAR

Over 175,000 pounds at take-off, less than 4½ hours and 3000 miles later, over 125,000 pounds to land!

Convair 880 jet transports will be using Cleveland Pneumatic AEROL landing gears.

Cleveland Pneumatic's design, test, and production facilities are

at work now on landing gears for *all three* American jet transports—Boeing 707, Douglas DC-8, and Convair 880. Since 1926 Cleveland Pneumatic has developed and built more landing gears for more aircraft than any other manufacturer.

Put our experience and plant to work on your next aircraft project.

**A JOB AT
CLEVELAND
PNEUMATIC**

offers many benefits for qualified engineers—liberal profit-sharing, good wages and fringe benefits, stability assured.

Write today, outlining your qualifications.

CLEVELAND PNEUMATIC

TOOL COMPANY • CLEVELAND 5, OHIO



TPR is the latest in developments in optical missile tracking systems. Developed by Perkin-Elmer, the instrument is capable of photographing an object and following it in a horizontal

arc more than 1000 ft. The instrument works on film, a movie's speed and accuracy during an aerial fight. All recorded data can then be derived for instantaneous analysis

The bird watchers

recording telescopes developed by Perkin-Elmer will follow missiles going 10,000 mph.

The "birds" hunted by the Air Force missile program fly fast—some exceeding 10,000 miles an hour within seconds after takeoff. To track these experimental missiles in the field, Perkin-Elmer designed and built TPR (Telescope Photographic Recorder)—a mobile 100-1000 inch focal length recording telescope synchronized with two sighting telescopes, a camera unit and a complex electronic control system, all mounted on a specially modified four-wheel gas engine.

In developing TPR, Perkin-Elmer drew on

years of experience gained in designing some of the world's finest large optical systems. New missile-tracking instruments and computer innovations, both mobile and fixed, are being built in quantity by Perkin-Elmer.

In managing optical work electronics and mechanics, Perkin-Elmer offers unmatched capability. P-E's staff and image production facilities easily will hold the answer to your system problems. For information, write Perkin-Elmer Corporation 770 Main Avenue, Norwalk, Conn.



An air jet made of the type shown will be used by Perkin-Elmer, Inc.

ENGINEERING AND OPTICAL DIVISION

Perkin-Elmer Corporation
NORWALK, CONNECTICUT

previously ordered by approximately 68%. Four new radars, slated for initial delivery in about a year, will be installed at Chicksaw, Ga.; Sevier, Ore.; Newry, N.Y.; and Mississippi. Much First Amphibious will be installed as early as Washington, D. C., to be followed by installations at Boston, Los Angeles, Pittsburgh, Seattle, Miami, Denver, Salt Lake City, Oakland and Atlanta.

► **Naval Stable Platform**—Lightweight twin gyro stabilized platform which uses two "flexboard" gyros instead of conventional mechanical and vertical gyros has been developed by Sperry Rand for Wright Air Development Center. Two stabilized directional gyros mounted with spin axes horizontal and at right



angles to one another, give what Sperry says is "unprecedented accuracy in heading information and attitude-in-flight." Random drift rates are quoted at 1 deg. per hour in heading and 4.1 degrees per minute about vertical axis, unless magnetic or vertical drag bracts stabilized platform, including amplifiers, weighs only 25 lb.

► **Unattended Overnight**—Price Corp. reports that it has been performing traffic control evaluation programs with its own funds for some time. Company was not included among those listed as having ATC data processing study programs under way. (AW Sept. 30, p. 29)

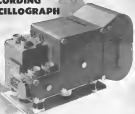
► **PAA Buys Airborne Radar**—Pan American World Airways has ordered 15 airborne radar receivers from Edo Corp., College Point, N. Y., for installation on new fleet of Douglas DC-8s and Boeing 707s. Inland, lightweight Model 167 Latus is designed for cockpit installation for use in pilot and copilot, weighs 25 lb.

► **AF Buys Infrared Range**—Airborne infrared reconnaissance systems will be installed on new fighter wings currently completed at Eglin AFB, believed to be the first of its type. Feltco provides provision for taking target resolution,

STABILITY in flight



**RECORDED ACCURATELY
By Century Model 409
RECORDING
OSCILLOGRAPH**



The Century Model 409 Oscillograph was designed for operation under the most adverse conditions, especially where space and weight considerations are limited. It is a miniature, compact unit incorporating many features found in larger models. Records faithfully during acceleration and shock in excess of 20 G's. Its size and capacity make it especially desirable for use in missile launching, parachute seat ejection, flight test of helicopter and fighter aircraft and torpedo studies.

Century Electronics & Instruments, Inc.

1223 No. Wilcox, Tulsa, Oklahoma

Announcing...

Two new

Titanium alloys for high temperature applications

MST 821... the highest strength weldable steel & bar alloy in 400-2000°F range

MST 2.5A1-16V... the first readily formable, heat treatable steel alloy

Two new alloys developed by Mallory-Sharon now extend the high temperature usefulness of titanium. **MST 821** is a weldable sheet and bar material with exceptional high temperature strength. It offers strength equivalent to stainless titanium alloys at temperatures two hundred degrees higher, in the 400 to 1900°F range. **MST 821** is thermally stable, and has good ductility and formability. **MST 2.5A1-16V** was developed in response to needs of the aircraft industry for a sheet alloy which

would be soft and formable in the annealed condition, and which could be heat treated, after forming, to high strengths while retaining ductility. With this material, yield strength can be as low as 50,000 psi, to permit easy fabrication, then increased to 150,000 psi by heat treatment. Age hardened sheet has good

short-term hot strength—about 300,000 psi yield strength up to 800°F. These alloys, now in limited commercial production, are further evidence of rapid advances in titanium. Use Mallory-Sharon's outstanding technical experience and service on your present requirements—or future plans—in titanium.

MALLORY SHARON

MALLORY-SHARON TITANIUM CORPORATION • NILES, OHIO

Producers of titanium and titanium alloy sheet, strip, plate, rod, bar, fittings



temperature differential sensitivity, and dynamic sensitivity.

Last system tested was the AN/VAR-9 infrared alarm system, in which alarms are tested for use during combat.

Boeing Studies Radiation Effects—Boeing Engineers Co. currently is studying effect of nuclear energy on radar performance, and life, to determine vulnerability of Boeing (DM-9) model's radar to radiation from atomic or plasma torches, which are being conducted near atomic pile at both Arco, Idaho, and Los Alamos, N. M.

Refuge for 1,000F Temperature—Development of new energies, incentive for infrared use at temperatures of 1,000F, with higher strength brought into this currently used ceramic detectors, is objective of new Wright Air

Development Center contract awarded to Itek Corp., Cleveland. Another contract calls for development of cooling technique to prevent radiation of evidence of 2,500F temperatures.

On The Dotted Line—New contracts recently announced by Avco Corp. include:

Radio—Radio automatic direction finder, DR-470, will be used in dual installation on Air Force fleet of Convair planes.

Concave Radar & Electronics Ltd., has secured contract from Luxembourg Ministry of Transport for dual installation of its G-21 non-reflective radar including two remote radar display units.

Systems, Inc., Orlando, Fla., has

secured contract for research and development in the field of remote guidance including systems from Wright Air Development Center.

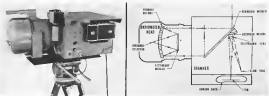
Marcus's Wireless Telephone Co. Ltd., Chesham, England, will supply two 500 kw. sun-actuated radio stations to New Zealand Civil Aviation Authority. One of the radio stations will be installed at Whangarei N. Z. to serve the Cook Street Zone and Rangitikei Airport, the other at Christchurch, New Zealand.

Lightweight Doppler Navigation—Rum Aeromaterial reports res. Model 105 Doppler auto navigator called the lightest in flight use to date of the navigation system, has been installed on Air Force 1-20 for flight evaluation at Ames Electronics Proving Ground, Ft. Hare, Ohio.



Infrared Camera Detects Variation Of Temperature

Infrared photo of Vacuum (above) taken and streamers on many day after testing, shows relative temperature of different portions of aircraft by brightness or darkness in the photo. Windows are solid (dark) because of air conditioning coils. Engines and top of fuselage are comparatively cool. Belly is warm because of exhaust gases, infrared from concrete apron. Infrared camera (below) produced by Bunker Engineering Co. contains vacuum window which serves as eyepiece with infrared detector camera, reflecting great source of visible light from glow tube onto film of Polaroid camera to produce photo shown above. Infrared camera can be used to inspect aerial equipment, detect leaks with and orienting of outboard parts.



Lycoming's T53

PROVEN...IN FLIGHT

Low-cost T53 Registers More Hours Of Flight Time Than Any Other Comparable Turbine!



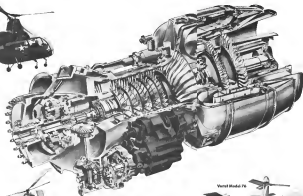
Grumman Model A-1B



Bell H-10



Sikorski HO4S



Cutaway of Lycoming T53



Vertol Model 10



Vertol Model 76

Its remarkably low production costs is but one reason why 6 major aircraft companies have selected the T53. Installed in the Bell H-40 and Kaman H-40B helicopters, the T53 has already earned a reputation as an engine "You can kick" and "Don't need to baby in flight." In addition, the T53 was chosen to power Grumman's new A-1B High-Performance Observation Airplane as well as Vertol's Model 76 tilt-wing aircraft and Model 100 helicopter, a turbine-powered version of the H-35. The Ryan Model 90 and Desik Model 10 aircraft—now being needed for flight—will also use the T53. In flying time experience, the T53 has recorded more hours than any other turbine engine in the same power class!

Built under the sponsorship of the U. S. Army and the U. S. Air Force, the low-cost T53 has also been installed in a power package for a high-speed U. S. Navy boat. Its easy adaptability to all sorts of applications has therefore been proven in practice.

Right now, the T53 helicopter version offers 625 e.s.p., but that rating will increase to over 1,000 e.s.p. in the foreseeable future. The latest turbo-prop version delivers 1,800 e.s.p. from a compact 47 1/2" length x 23" diameter. The T53 operates on a number of fuels, including automotive and aviation gasolines and JP-4. Now entering full production, Lycoming's T53 is designed especially for safety, durability, easy maintenance, as well as high power with low weight. Perhaps it can solve your future problems now!

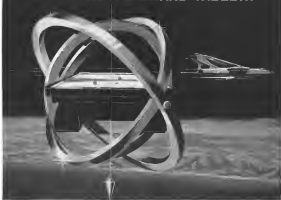
Look to Lycoming

For further information, write to: Lycoming Division, Avco Manufacturing Corporation, 550 South Main Street, Stratford, Connecticut.

Avco
Lycoming

Admiral

KEEPS AERIAL CAMERAS STABLE AS A BILLIARD TABLE...



ADMIRAL'S PALO ALTO LABORATORY DEVELOPS
EQUIPMENT FOR CAMERA STABILIZATION

The art of aerial photo reconnaissance requires absolute camera stability to obtain the fine detail needed to discern small objects from great altitudes. Even with an automatic pilot in control, the plane itself is far too susceptible for reconnaissance work, and additional stabilization is required.

Now Admiral has developed equipment that automatically compensates for the slightest deviation. Electronic signals from gyroscopes are precisely modified and formulated as needed to stabilize each of the various camera mounts. The accuracy of the gyro signals is fully ascertained in the mechanical adjustments of each camera platform. Moreover, Admiral has applied rate-of-acceleration techniques to reduce size and weight to half of the original equipment specifications.

This system was developed in Admiral's Palo Alto Laboratory by the Advanced Development Section, Government Laboratories Division. Complete schematics accompany the Laboratory's capabilities and current activities are available to qualified persons.

1250 to Admiral
• REQUEST
• FURNISHMENT
• REPLY

IN THE FIELD OF: INSTANT TELETYPE COMMUNICATIONS LINE AND TIE - RADIO BASE STATIONS AND BY - RADIO TELETYPE - DISTANCE MEASURING INSTRUMENTS - SIGNALS AND RECORDING CURRENT DELAY LINES - TEST EQUIPMENT ELECTRONIC THERMISTORS

DISCLAIMER: The work copies of work to prepare all Admiral units, including no responsibility to the field of your site or those shown at the drawing and research, Admiral Corporation, Chicago 42, Illinois.

NEW AVIONIC PRODUCTS

Components & Devices

• Pressure pickup, Type 4-317, is available in gauge pressure ranges to 5000 psi, and can be operated continuously at 50 volts maximum input from -515 to +500 F with transients to +750 F. Allowable acceleration is 100 Gs on any



non. Linearity and hysteresis deviation considered are less than $\pm 0.5\%$ of full range output. Unit is 1 in. in diameter, 1 in. long, and weighs 20 grams. Manufacturer: Consolidated Electronics Corp., 100 N. Santa Maria Villa, Pasadena, Calif.

• Aluminum electrolytic capacitors, and in fact only a few micropercents of electrical leakage, are available in sizes from 1 to 125 μ and 4 to 150 volts d.c. for temperature range of -20 to +55 C. Lengths are from 1



in. to 12 in. and diameter from 1/8 in. to 1 in. Unit has control panel built into one is standard. Sealing is with copper casting resin. Manufacturer: The Magnetics Co., Fort Wayne, Ind.

• Two precision potentiometers, Types HA-100 and HA-101, are available in 5 and 10 turn models with standard linearity of $\pm 0.5\%$. Case lengths are 11 in. for HA-100, and 11 in. for 10 turn HA-101, and at 2 watts and



for jet engines and aircraft applications

Edgewater rings



Edgewater Rings meet the most exacting specifications of the engine and aircraft industries. The accuracy with which they are formed reduces the amount of machining or other finishing required—an important consideration especially when the more expensive materials are used.



Edgewater Steel Company

P.O. Box 478 • Pittsburgh 46, Penna.

Write for brochures giving data on Edgewater Rings.

Holley engine controls selected for JT4 engines on America's first jet airliner



BLEED PISTON ACTUATOR



COMPRESSOR BLEED GOVERNOR



Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 131 first class passengers from New York non-stop to the Continent in just over six hours! Each of these new engines, conceptual counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 15,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce overall weight.

Holley Carburetor Company, work-

ing closely with Pratt & Whitney Aircraft engineers, carried out the engineering assignment on such vital engine components as the compressor bleed governor, and the bleed

governor actuator. For angle and valve-engine military aircraft, the Holley main fuel control is a compressor act to the Holley governor and actuator.



For engine applications, the Holley main fuel control (right) is a compressor act to the governor and actuator.



11555 E. Main Mile Road, Warren, Michigan

Engine Design, Development and Manufacturing of Aircraft Fuel Metering Systems

with 1,600 deg. rotation, is available in standard resistance values from 2,500 to 75,000 ohms. SIA 105, used at 1.5 volts and with 1,600 deg. rotation, is available in values from 1,000 to 25,000 ohms.

Write: International Resistor Co., 401 N. Broad St., Philadelphia 6, Pa., for Bulletin A 58.

• **Macaroni**, approximately 1 in. in diameter by 1 in. long, has acrobatic of 500 revolutions per deg., with thrust of 0.81 deg. at 78 volt excitation. Linearity is within 0.5% to 7 deg.



Unit weighs less than 1/2 oz., uses fixed and fixed mounting. Excitation may be 20 volt/400 cps at 25 volt/800 cps. Manufacturer: Lear, Inc., 110 Iowa Ave., NW, Grand Rapids 2, Mich.

• **Interpreting rate gyro**, Type KR-5, is (indicated) self-contained temperature control operating on the heat-of-fusion principle to maintain 10C with tolerance of 4 deg.

Unit is 3 in. long, 2 in. in diameter,



weighs 11 lb. Motor is 3 phase 5-7 volts 400 cycles, 1-75 watts. Case is unshielded in General Electric Company's Light Military Electronics Equipment Department, Schenectady, New York.

• **Low frequency duplex crystal unit**, Type RD 10P, is used to meet MIL C 3091B specifications for shock, vibration, aging and moisture resistance. Units provide accurate frequency, can trail in audio range of from 4 to 15 kc, are operable over temperature range of -15° to +90C with stability of $\pm 0.05\%$. They are available in standard 10C/10V crystal holder, hermeti-



cally sealed, or in TE glass hermetic seal. Manufacturer: Raytheon Company, Division, Dynamics Corp of America, Cambridge, Pa.

• **Pulse transducer**, called SIA 1 TRANS, for use in transducer blocking oscillator circuits have built-in over

with high permeability (2,400 G). Units have low leakage, inductance and present a good impedance match to the transducer which permits operation at



repetition rates to 100 kc. Dimensions are 6 in. diameter by 1 in. long. Also electronic. Write: Engineering Dept. 7657 Spring St., Redwood City, Calif.



"WE KEEP 'EM FLYING"

Air Associates stocks the largest, most complete inventory of aircraft parts and accessories in the aviation industry. And Air Associates' tremendous buying power brings them to you at the most advantageous prices. You can always count on AA's having what you want, delivering what you want, whenever and wherever you want it. That's why Air Associates is truly your Department Store of the Air. To serve the entire in aviation, there are Air Associates divisions at:

| | |
|------------------|-----------------------|
| Atlanta, Ga. | Glenade, Calif. |
| Chicago, Ill. | Miami, Fla. |
| Dallas, Tex. | San Francisco, Calif. |
| Teterboro, N. J. | |



Tracking Camera Photographs Details of

Missile Flight

By George L. Christian

New York—Cady program to produce a missile data collection system and telescopic tracking camera capable of following and photographing an Atlas I environmental ballistic missile for over 100 mi has resulted in a Rotating Optical Tracking Instrument Mark II.

Rotating Optical Tracking Instrument (ROTI) was tested into stress to track recent Thor, IRBM and Atlas ICBM landings at Air Force Missile Test Center, Patrick AFB, Fla. (AW Oct 7, p. 24).

Instrument's powerful magnification, coupled with a high-speed 70 mm camera, enable it to record such details of missile behavior as engine gunbling, booster rocket performance and solid stage discharge, even at high altitudes.

Principal instrument of the data collection station is the large optical tracking instrument ROTI II. Camouflage device has a 34-in aperture and five focal lengths ranging from 100 in to 450 in. This is more than double ROTI I, developed to track V-2 class rockets which had an aperture of 12 in and a 45 in focal length.

ROTI II is similar to, but is more sensitive and has greater magnification than. Telescopic Photographic Receiver, a small, mobile rocket-mounted device (USAF's Air Research and Development Command at Air Force Assessment Center, Eglin AFB, Fla. (AW Feb 1, p. 25)).

ROTI and Telescopic Photographic Receiver were designed and manufactured by Perkin-Elmer Corp., Norwalk, Conn.

First of Four

McDonnell-Buch ROTI is the first of four being built for Air Force Missile Test Center. Second data collection station is nearing completion at Vero Beach, Fla. Perkin-Elmer is also building similar instruments for other, undisclosed Air Force stations.

ROTI data collection station operates as an integral part of the Patrick range communication and tracking network.

Information from radar and other communication nets are fed into the station when a missile is fired. Computers at the station convert this data into information which keeps ROTI tracking as target.

Automatic computers are able to adjust for parallel-displacement in line of sight from radar station to ROTI the

horizontal for the earth's curvature.

ROTI will be focused automatically and will have exposure automatically adjusted to changing light conditions as the missile blazes across the sky.

ROTI consists of a 34-in aperture primary objective telescope, sighting telescopes, camera, controls and associated equipment. Motors, which weigh eight tons, is mounted on a Navy 5-in gas motor.

Primary telescope has viewing focal lengths ranging from 100 in to 450 in. It is 12 in in diameter, eight feet long and weighs a ton. It incorporates over 200 different optical elements and a 70 mm camera which can take moving pictures at a rate of up to 60 frames a second.

Observatory-Like Towers

ROTI is housed in towers, topped by astronomical observation-like rotors. Rotors can be operated by remote control or by range personnel with the help of "radio tracking."

When operated by range personnel, range information is fed into the tracking system so when the rotors operate remotely. However, when the missile comes into sight, the operators take over the tracking visually.

With aided tracking, operators need only make the simplest mental calculations and very slight physical movements to follow the missile. Light beam pointers on a star-like control, developed by Perkin-Elmer, enables the operator to adjust acceleration, velocity and position of the 1,000 lb-telescope through two electrically-controlled hydraulic devices.

Interior of the substructure is automatically air conditioned to remain at ambient temperature when the dome is closed and vented. Provision is also made for setting the interior down temperature to the temperature expected at the dome's opening. Reason is that if it is imperative to stabilize the temperature of the optical instrument with ambient temperature to avoid thermal shock when the dome is opened for missile tracking. Such shock could disturb the instrument's optics.

As conditioning system also keeps the system's humidity below 50% to prevent glass surfaces from fogging and to retard corrosion.

Separate air conditioning system maintains a temperature of 70° ± 10°, and a maximum relative humidity of 75% in the tower.

System are completely self sufficient



ROTI II. Above: truck in its substructure (above) at McDonnell-Buch, Patrick AFB, Fla. Tracking camera (below) is mounted at back of 200-500-in.-long trailer telescope.



OPERATORS can rotate the ROTI II (above). Photograph of MAVER C-130 was taken by ROTI II at 16-in range, illustrating camera's ability to pick up detail.





1927 _____



1928 _____



1931 _____



1934 _____



1935 _____



1936 _____



1937 _____



1938 _____



1940 _____



1945 _____



1947 _____



1948 _____



1949 _____



1952 _____



1955 _____



1958 _____



1959 _____



30th Anniversary Clipper Quiz

On the morning of Oct. 28, 1937, a staccato roar of engines subdued in an era in commercial aviation—the Stars and Stripes flew in international skies.

The first Flying Clipper,* a Fokker F-7, lumbered into the air at Pan American Field, in Key West bound for Havana, Cuba—90 miles away across the Straits of Florida.

Since then the parade of Pan American Clippers has swiftly extended its wings to embrace the earth—

wings that have changed from the 100-mile-an-hour variety, to swept back jobs that nuzzle the speed of sound. And Pan American has earned its place as pace-setter in the skies: aircraft research, engine advances, reduced air fares, jet stream studies, the creation of and adherence to the standards that have made the slogan—*The World's Most Experienced Airline*—an international reality.

Behind Pan Am's relentless attempt to attain perfection is the philosophy of this airline: A philos-

ophy that is essential to stimulating the growth of the aviation industry—make the range of air travel available to every man.

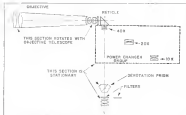
30 years of leadership

In the past 30 years Pan American's skyway has grown from that first 90-mile flight to encompass 82 lands on 6 continents around the world. In the

next 30 years, we can surely harnessed galaxies and dreams—but whatever progress develops, Pan American will be, as in the past, in the forefront of international aviation.

REGISTRATION NO. 114-707-000

MODELS: 1937 F-7, 1940 B, 1941 B, 1942 B, 1943 B, 1944 B, 1945 B, 1946 B, 1947 B, 1948 B, 1949 B, 1950 B, 1951 B, 1952 B, 1953 B, 1954 B, 1955 B, 1956 B, 1957 B, 1958 B, 1959 B, 1960 B, 1961 B, 1962 B, 1963 B, 1964 B, 1965 B, 1966 B, 1967 B, 1968 B, 1969 B, 1970 B, 1971 B, 1972 B, 1973 B, 1974 B, 1975 B, 1976 B, 1977 B, 1978 B, 1979 B, 1980 B, 1981 B, 1982 B, 1983 B, 1984 B, 1985 B, 1986 B, 1987 B, 1988 B, 1989 B, 1990 B, 1991 B, 1992 B, 1993 B, 1994 B, 1995 B, 1996 B, 1997 B, 1998 B, 1999 B, 2000 B, 2001 B, 2002 B, 2003 B, 2004 B, 2005 B, 2006 B, 2007 B, 2008 B, 2009 B, 2010 B, 2011 B, 2012 B, 2013 B, 2014 B, 2015 B, 2016 B, 2017 B, 2018 B, 2019 B, 2020 B, 2021 B, 2022 B, 2023 B, 2024 B, 2025 B, 2026 B, 2027 B, 2028 B, 2029 B, 2030 B, 2031 B, 2032 B, 2033 B, 2034 B, 2035 B, 2036 B, 2037 B, 2038 B, 2039 B, 2040 B, 2041 B, 2042 B, 2043 B, 2044 B, 2045 B, 2046 B, 2047 B, 2048 B, 2049 B, 2050 B, 2051 B, 2052 B, 2053 B, 2054 B, 2055 B, 2056 B, 2057 B, 2058 B, 2059 B, 2060 B, 2061 B, 2062 B, 2063 B, 2064 B, 2065 B, 2066 B, 2067 B, 2068 B, 2069 B, 2070 B, 2071 B, 2072 B, 2073 B, 2074 B, 2075 B, 2076 B, 2077 B, 2078 B, 2079 B, 2080 B, 2081 B, 2082 B, 2083 B, 2084 B, 2085 B, 2086 B, 2087 B, 2088 B, 2089 B, 2090 B, 2091 B, 2092 B, 2093 B, 2094 B, 2095 B, 2096 B, 2097 B, 2098 B, 2099 B, 2100 B, 2101 B, 2102 B, 2103 B, 2104 B, 2105 B, 2106 B, 2107 B, 2108 B, 2109 B, 2110 B, 2111 B, 2112 B, 2113 B, 2114 B, 2115 B, 2116 B, 2117 B, 2118 B, 2119 B, 2120 B, 2121 B, 2122 B, 2123 B, 2124 B, 2125 B, 2126 B, 2127 B, 2128 B, 2129 B, 2130 B, 2131 B, 2132 B, 2133 B, 2134 B, 2135 B, 2136 B, 2137 B, 2138 B, 2139 B, 2140 B, 2141 B, 2142 B, 2143 B, 2144 B, 2145 B, 2146 B, 2147 B, 2148 B, 2149 B, 2150 B, 2151 B, 2152 B, 2153 B, 2154 B, 2155 B, 2156 B, 2157 B, 2158 B, 2159 B, 2160 B, 2161 B, 2162 B, 2163 B, 2164 B, 2165 B, 2166 B, 2167 B, 2168 B, 2169 B, 2170 B, 2171 B, 2172 B, 2173 B, 2174 B, 2175 B, 2176 B, 2177 B, 2178 B, 2179 B, 2180 B, 2181 B, 2182 B, 2183 B, 2184 B, 2185 B, 2186 B, 2187 B, 2188 B, 2189 B, 2190 B, 2191 B, 2192 B, 2193 B, 2194 B, 2195 B, 2196 B, 2197 B, 2198 B, 2199 B, 2200 B, 2201 B, 2202 B, 2203 B, 2204 B, 2205 B, 2206 B, 2207 B, 2208 B, 2209 B, 2210 B, 2211 B, 2212 B, 2213 B, 2214 B, 2215 B, 2216 B, 2217 B, 2218 B, 2219 B, 2220 B, 2221 B, 2222 B, 2223 B, 2224 B, 2225 B, 2226 B, 2227 B, 2228 B, 2229 B, 2230 B, 2231 B, 2232 B, 2233 B, 2234 B, 2235 B, 2236 B, 2237 B, 2238 B, 2239 B, 2240 B, 2241 B, 2242 B, 2243 B, 2244 B, 2245 B, 2246 B, 2247 B, 2248 B, 2249 B, 2250 B, 2251 B, 2252 B, 2253 B, 2254 B, 2255 B, 2256 B, 2257 B, 2258 B, 2259 B, 2260 B, 2261 B, 2262 B, 2263 B, 2264 B, 2265 B, 2266 B, 2267 B, 2268 B, 2269 B, 2270 B, 2271 B, 2272 B, 2273 B, 2274 B, 2275 B, 2276 B, 2277 B, 2278 B, 2279 B, 2280 B, 2281 B, 2282 B, 2283 B, 2284 B, 2285 B, 2286 B, 2287 B, 2288 B, 2289 B, 2290 B, 2291 B, 2292 B, 2293 B, 2294 B, 2295 B, 2296 B, 2297 B, 2298 B, 2299 B, 2300 B, 2301 B, 2302 B, 2303 B, 2304 B, 2305 B, 2306 B, 2307 B, 2308 B, 2309 B, 2310 B, 2311 B, 2312 B, 2313 B, 2314 B, 2315 B, 2316 B, 2317 B, 2318 B, 2319 B, 2320 B, 2321 B, 2322 B, 2323 B, 2324 B, 2325 B, 2326 B, 2327 B, 2328 B, 2329 B, 2330 B, 2331 B, 2332 B, 2333 B, 2334 B, 2335 B, 2336 B, 2337 B, 2338 B, 2339 B, 2340 B, 2341 B, 2342 B, 2343 B, 2344 B, 2345 B, 2346 B, 2347 B, 2348 B, 2349 B, 2350 B, 2351 B, 2352 B, 2353 B, 2354 B, 2355 B, 2356 B, 2357 B, 2358 B, 2359 B, 2360 B, 2361 B, 2362 B, 2363 B, 2364 B, 2365 B, 2366 B, 2367 B, 2368 B, 2369 B, 2370 B, 2371 B, 2372 B, 2373 B, 2374 B, 2375 B, 2376 B, 2377 B, 2378 B, 2379 B, 2380 B, 2381 B, 2382 B, 2383 B, 2384 B, 2385 B, 2386 B, 2387 B, 2388 B, 2389 B, 2390 B, 2391 B, 2392 B, 2393 B, 2394 B, 2395 B, 2396 B, 2397 B, 2398 B, 2399 B, 2400 B, 2401 B, 2402 B, 2403 B, 2404 B, 2405 B, 2406 B, 2407 B, 2408 B, 2409 B, 2410 B, 2411 B, 2412 B, 2413 B, 2414 B, 2415 B, 2416 B, 2417 B, 2418 B, 2419 B, 2420 B, 2421 B, 2422 B, 2423 B, 2424 B, 2425 B, 2426 B, 2427 B, 2428 B, 2429 B, 2430 B, 2431 B, 2432 B, 2433 B, 2434 B, 2435 B, 2436 B, 2437 B, 2438 B, 2439 B, 2440 B, 2441 B, 2442 B, 2443 B, 2444 B, 2445 B, 2446 B, 2447 B, 2448 B, 2449 B, 2450 B, 2451 B, 2452 B, 2453 B, 2454 B, 2455 B, 2456 B, 2457 B, 2458 B, 2459 B, 2460 B, 2461 B, 2462 B, 2463 B, 2464 B, 2465 B, 2466 B, 2467 B, 2468 B, 2469 B, 2470 B, 2471 B, 2472 B, 2473 B, 2474 B, 2475 B, 2476 B, 2477 B, 2478 B, 2479 B, 2480 B, 2481 B, 2482 B, 2483 B, 2484 B, 2485 B, 2486 B, 2487 B, 2488 B, 2489 B, 2490 B, 2491 B, 2492 B, 2493 B, 2494 B, 2495 B, 2496 B, 2497 B, 2498 B, 2499 B, 2500 B, 2501 B, 2502 B, 2503 B, 2504 B, 2505 B, 2506 B, 2507 B, 2508 B, 2509 B, 2510 B, 2511 B, 2512 B, 2513 B, 2514 B, 2515 B, 2516 B, 2517 B, 2518 B, 2519 B, 2520 B, 2521 B, 2522 B, 2523 B, 2524 B, 2525 B, 2526 B, 2527 B, 2528 B, 2529 B, 2530 B, 2531 B, 2532 B, 2533 B, 2534 B, 2535 B, 2536 B, 2537 B, 2538 B, 2539 B, 2540 B, 2541 B, 2542 B, 2543 B, 2544 B, 2545 B, 2546 B, 2547 B, 2548 B, 2549 B, 2550 B, 2551 B, 2552 B, 2553 B, 2554 B, 2555 B, 2556 B, 2557 B, 2558 B, 2559 B, 2560 B, 2561 B, 2562 B, 2563 B, 2564 B, 2565 B, 2566 B, 2567 B, 2568 B, 2569 B, 2570 B, 2571 B, 2572 B, 2573 B, 2574 B, 2575 B, 2576 B, 2577 B, 2578 B, 2579 B, 2580 B, 2581 B, 2582 B, 2583 B, 2584 B, 2585 B, 2586 B, 2587 B, 2588 B, 2589 B, 2590 B, 2591 B, 2592 B, 2593 B, 2594 B, 2595 B, 2596 B, 2597 B, 2598 B, 2599 B, 2600 B, 2601 B, 2602 B, 2603 B, 2604 B, 2605 B, 2606 B, 2607 B, 2608 B, 2609 B, 2610 B, 2611 B, 2612 B, 2613 B, 2614 B, 2615 B, 2616 B, 2617 B, 2618 B, 2619 B, 2620 B, 2621 B, 2622 B, 2623 B, 2624 B, 2625 B, 2626 B, 2627 B, 2628 B, 2629 B, 2630 B, 2631 B, 2632 B, 2633 B, 2634 B, 2635 B, 2636 B, 2637 B, 2638 B, 2639 B, 2640 B, 2641 B, 2642 B, 2643 B, 2644 B, 2645 B, 2646 B, 2647 B, 2648 B, 2649 B, 2650 B, 2651 B, 2652 B, 2653 B, 2654 B, 2655 B, 2656 B, 2657 B, 2658 B, 2659 B, 2660 B, 2661 B, 2662 B, 2663 B, 2664 B, 2665 B, 2666 B, 2667 B, 2668 B, 2669 B, 2670 B, 2671 B, 2672 B, 2673 B, 2674 B, 2675 B, 2676 B, 2677 B, 2678 B, 2679 B, 2680 B, 2681 B, 2682 B, 2683 B, 2684 B, 2685 B, 2686 B, 2687 B, 2688 B, 2689 B, 2690 B, 2691 B, 2692 B, 2693 B, 2694 B, 2695 B, 2696 B, 2697 B, 2698 B, 2699 B, 2700 B, 2701 B, 2702 B, 2703 B, 2704 B, 2705 B, 2706 B, 2707 B, 2708 B, 2709 B, 2710 B, 2711 B, 2712 B, 2713 B, 2714 B, 2715 B, 2716 B, 2717 B, 2718 B, 2719 B, 2720 B, 2721 B, 2722 B, 2723 B, 2724 B, 2725 B, 2726 B, 2727 B, 2728 B, 2729 B, 2730 B, 2731 B, 2732 B, 2733 B, 2734 B, 2735 B, 2736 B, 2737 B, 2738 B, 2739 B, 2740 B, 2741 B, 2742 B, 2743 B, 2744 B, 2745 B, 2746 B, 2747 B, 2748 B, 2749 B, 2750 B, 2751 B, 2752 B, 2753 B, 2754 B, 2755 B, 2756 B, 2757 B, 2758 B, 2759 B, 2760 B, 2761 B, 2762 B, 2763 B, 2764 B, 2765 B, 2766 B, 2767 B, 2768 B, 2769 B, 2770 B, 2771 B, 2772 B, 2773 B, 2774 B, 2775 B, 2776 B, 2777 B, 2778 B, 2779 B, 2780 B, 2781 B, 2782 B, 2783 B, 2784 B, 2785 B, 2786 B, 2787 B, 2788 B, 2789 B, 2790 B, 2791 B, 2792 B, 2793 B, 2794 B, 2795 B, 2796 B, 2797 B, 2798 B, 2799 B, 2800 B, 2801 B, 2802 B, 2803 B, 2804 B, 2805 B, 2806 B, 2807 B, 2808 B, 2809 B, 2810 B, 2811 B, 2812 B, 2813 B, 2814 B, 2815 B, 2816 B, 2817 B, 2818 B, 2819 B, 2820 B, 2821 B, 2822 B, 2823 B, 2824 B, 2825 B, 2826 B, 2827 B, 2828 B, 2829 B, 2830 B, 2831 B, 2832 B, 2833 B, 2834 B, 2835 B, 2836 B, 2837 B, 2838 B, 2839 B, 2840 B, 2841 B, 2842 B, 2843 B, 2844 B, 2845 B, 2846 B, 2847 B, 2848 B, 2849 B, 2850 B, 2851 B, 2852 B, 2853 B, 2854 B, 2855 B, 2856 B, 2857 B, 2858 B, 2859 B, 2860 B, 2861 B, 2862 B, 2863 B, 2864 B, 2865 B, 2866 B, 2867 B, 2868 B, 2869 B, 2870 B, 2871 B, 2872 B, 2873 B, 2874 B, 2875 B, 2876 B, 2877 B, 2878 B, 2879 B, 2880 B, 2881 B, 2882 B, 2883 B, 2884 B, 2885 B, 2886 B, 2887 B, 2888 B, 2889 B, 2890 B, 2891 B, 2892 B, 2893 B, 2894 B, 2895 B, 2896 B, 2897 B, 2898 B, 2899 B, 2900 B, 2901 B, 2902 B, 2903 B, 2904 B, 2905 B, 2906 B, 2907 B, 2908 B, 2909 B, 2910 B, 2911 B, 2912 B, 2913 B, 2914 B, 2915 B, 2916 B, 2917 B, 2918 B, 2919 B, 2920 B, 2921 B, 2922 B, 2923 B, 2924 B, 2925 B, 2926 B, 2927 B, 2928 B, 2929 B, 2930 B, 2931 B, 2932 B, 2933 B, 2934 B, 2935 B, 2936 B, 2937 B, 2938 B, 2939 B, 2940 B, 2941 B, 2942 B, 2943 B, 2944 B, 2945 B, 2946 B, 2947 B, 2948 B, 2949 B, 2950 B, 2951 B, 2952 B, 2953 B, 2954 B, 2955 B, 2956 B, 2957 B, 2958 B, 2959 B, 2960 B, 2961 B, 2962 B, 2963 B, 2964 B, 2965 B, 2966 B, 2967 B, 2968 B, 2969 B, 2970 B, 2971 B, 2972 B, 2973 B, 2974 B, 2975 B, 2976 B, 2977 B, 2978 B, 2979 B, 2980 B, 2981 B, 2982 B, 2983 B, 2984 B, 2985 B, 2986 B, 2987 B, 2988 B, 2989 B, 2990 B, 2991 B, 2992 B, 2993 B, 2994 B, 2995 B, 2996 B, 2997 B, 2998 B, 2999 B, 3000 B, 3001 B, 3002 B, 3003 B, 3004 B, 3005 B, 3006 B, 3007 B, 3008 B, 3009 B, 3010 B, 3011 B, 3012 B, 3013 B, 3014 B, 3015 B, 3016 B, 3017 B, 3018 B, 3019 B, 3020 B, 3021 B, 3022 B, 3023 B, 3024 B, 3025 B, 3026 B, 3027 B, 3028 B, 3029 B, 3030 B, 3031 B, 3032 B, 3033 B, 3034 B, 3035 B, 3036 B, 3037 B, 3038 B, 3039 B, 3040 B, 3041 B, 3042 B, 3043 B, 3044 B, 3045 B, 3046 B, 3047 B, 3048 B, 3049 B, 3050 B, 3051 B, 3052 B, 3053 B, 3054 B, 3055 B, 3056 B, 3057 B, 3058 B, 3059 B, 3060 B, 3061 B, 3062 B, 3063 B, 3064 B, 3065 B, 3066 B, 3067 B, 3068 B, 3069 B, 3070 B, 3071 B, 3072 B, 3073 B, 3074 B, 3075 B, 3076 B, 3077 B, 3078 B, 3079 B, 3080 B, 3081 B, 3082 B, 3083 B, 3084 B, 3085 B, 3086 B, 3087 B, 3088 B, 3089 B, 3090 B, 3091 B, 3092 B, 3093 B, 3094 B, 3095 B, 3096 B, 3097 B, 3098 B, 3099 B, 3100 B, 3101 B, 3102 B, 3103 B, 3104 B, 3105 B, 3106 B, 3107 B, 3108 B, 3109 B, 3110 B, 3111 B, 3112 B, 3113 B, 3114 B, 3115 B, 3116 B, 3117 B, 3118 B, 3119 B, 3120 B, 3121 B, 3122 B, 3123 B, 3124 B, 3125 B, 3126 B, 3127 B, 3128 B, 3129 B, 3130 B, 3131 B, 3132 B, 3133 B, 3134 B, 3135 B, 3136 B, 3137 B, 3138 B, 3139 B, 3140 B, 3141 B, 3142 B, 3143 B, 3144 B, 3145 B, 3146 B, 3147 B, 3148 B, 3149 B, 3150 B, 3151 B, 3152 B, 3153 B, 3154 B, 3155 B, 3156 B, 3157 B, 3158 B, 3159 B, 3160 B, 3161 B, 3162 B, 3163 B, 3164 B, 3165 B, 3166 B, 3167 B, 3168 B, 3169 B, 3170 B, 3171 B, 3172 B, 3173 B, 3174 B, 3175 B, 3176 B, 3177 B, 3178 B, 3179 B, 3180 B, 3181 B, 3182 B, 3183 B, 3184 B, 3185 B, 3186 B, 3187 B, 3188 B, 3189 B, 3190 B, 3191 B, 3192 B, 3193 B, 3194 B, 3195 B, 3196 B, 3197 B, 3198 B, 3199 B, 3200 B, 3201 B, 3202 B, 3203 B, 3204 B, 3205 B, 3206 B, 3207 B, 3208 B, 3209 B, 3210 B, 3211 B, 3212 B, 3213 B, 3214 B, 3215 B, 3216 B, 3217 B, 3218 B, 3219 B, 3220 B, 3221 B, 3222 B, 3223 B, 3224 B, 3225 B, 3226 B, 3227 B, 3228 B, 3229 B, 3230 B, 3231 B, 3232 B, 3233 B, 3234 B, 3235 B, 3236 B, 3237 B, 3238 B, 3239 B, 3240 B, 3241 B, 3242 B, 3243 B, 3244 B, 3245 B, 3246 B, 3247 B, 3248 B, 3249 B, 3250 B, 3251 B, 3252 B, 3253 B, 3254 B, 3255 B, 3256 B, 3257 B, 3258 B, 3259 B, 3260 B, 3261 B, 3262 B, 3263 B, 3264 B, 3265 B, 3266 B, 3267 B, 3268 B, 3269 B, 3270 B, 3271 B, 3272 B, 3273 B, 3274 B, 3275 B, 3276 B, 3277 B, 3278 B, 3279 B, 3280 B, 3281 B, 3282 B, 3283 B, 3284 B, 3285 B, 3286 B, 3287 B, 3288 B, 3289 B, 3290 B, 3291 B, 3292 B, 3293 B, 3294 B, 3295 B, 3296 B, 3297 B, 3298 B, 3299 B, 3300 B, 3301 B, 3302 B, 3303 B, 3304 B, 3305 B, 3306 B, 3307 B, 3308 B, 3309 B, 3310 B, 3311 B, 3312 B, 3313 B, 3314 B, 3315 B, 3316 B, 3317 B, 3318 B, 3319 B, 3320 B, 3321 B, 3322 B, 3323 B, 3324 B, 3325 B, 3326 B, 3327 B, 3328 B, 3329 B, 3330 B, 3331 B, 3332 B, 3333 B, 3334 B, 3335 B, 3336 B, 3337 B, 3338 B, 3339 B, 3340 B, 3341 B, 3342 B, 3343 B, 3344 B, 3345 B, 3346 B, 3347 B, 3348 B, 3349 B, 3350 B, 3351 B, 3352 B, 3353 B, 3354 B, 3355 B, 3356 B, 3357 B, 3358 B, 3359 B, 3360 B, 3361 B, 3362 B, 3363 B, 3364 B, 3365 B, 3366 B, 3367 B, 3368 B, 3369 B, 3370 B, 3371 B, 3372 B, 3373 B, 3374 B, 3375 B, 3376 B, 3377 B, 3378 B, 3379 B, 3380 B, 3381 B, 3382 B, 3383 B, 3384 B, 3385 B, 3386 B, 3387 B, 3388 B, 3389 B



SIMPLIFIED schematic diagram shows the optical system of R011-B instrument has 24x4 apertures, five focal lengths ranging from 180 in. to 580 in.

units. They include their own electronic and mechanical equipment, computers, dark rooms for film developing, surveillance section and air conditioning systems.

Dr. Rodere M. Scott, Perkin Elmer vice president and general manager of its Engineering & Optical division, believes that R011-B will give much needed reconnaissance visual and infrared data and relay information concerning a mission's successful or unsuccessful flight.

Dr. Scott added, "R011-B's photo-

graphic tracking system because a valuable commodity, especially when studied against the extra scientific resources that could be spent probing for a missile's host."

Bendix designing and building R011-B. Perkin Elmer Corp. is also responsible for construction of the data collection stations and for training personnel to operate them. Radar Corporation of America Service Corp., which has technical supervision of the specific stage, will operate the stations for the Air Force.



Voodoo Used as Engine Test Bed

First installation of General Electric T5 turbojet engines in a McDonnell RF11A Voodoo fighter aircraft being designed and completed under contract to the Air Force. Engine test bed is based at Edwards AFB, Calif.

ENGINEERS

...Specialize in
Electronics in space
electronics of THE
GARRETT CORPORATION

Increased activity in the design and production of systems electronics has created openings for engineers in the following areas:

ELECTRONIC AND AIR DATA SYSTEMS Engineers are men of precision engineering capabilities. Also required are development and design engineers with specialized experience in stress mechanisms, circuit and analog computer design, control systems, telemetry, and computer applications.

Servo Mechanisms and Electro-Mechanics Complete working knowledge of electro-mechanical theory and familiarity with materials and methods employed in the design of response mechanisms is required.

Flight Instruments and Transducers Engineers capable of analyzing performance during preliminary design and able to prepare proposals and reports.

Flight Instruments Engineers required with the drafting and design of light mechanisms for production in which low losses, freedom from vibration effects and compensation of thermal expansion are important.

High Frequency Motors, Generators, Converters Requires electrical design engineers with BSEE or equivalent interested in high frequency motor, generator and inverter circuits.

Send resume of education and experience today to:

Mr. G. A. Bradley

THE GARRETT CORPORATION

RECEIVE: Department
1000 North Main Street
Garrett, Indiana 47401

Address: Engineering
1000 North Main Street
Garrett, Indiana 47401
Perkins Elmer
Radar Corporation
Aircraft Division
Garrett, Indiana 47401

Electronic Cooling Package...by AiResearch



SPECIFICATIONS OF TYPICAL AIRSEARCH COOLING PACKAGE

| | |
|---|------------------|
| Air Flow | 40 CFM |
| Per Air Inlet Pressure | 15 PSIA |
| Per Pressure Rise | 1.0 inches water |
| Heat Exchanger Pressure Drop | 1.0 inches water |
| Leak | None |
| Material | Aluminum |
| Weight | 8.5 LBS |
| Fluid Flow | 200 GPM |
| Per Pressure* | 200 PSI |
| Per Pressure | 200 PSI |
| Package size by dimension | 30" x 10" x 10" |
| Package weight | 8.5 lbs |
| *Assumes Class A (99%) electronic components | |
| Fluid inlet temperature in heat exchanger, °F | 100 |
| Excludes heat from fan motor | |

This high performance Airsearch package cools sealed and pressurized electronic equipment. The fan circulates air through the liquid cooled heat exchanger and over electronic components in a thermally sealed module. Air cooled units are also available. Fan and heat exchanger are designed, built and packaged by AiResearch for maximum performance. Package size is tailored to your individual cooling requirements.

The Garrett Corporation, through its AiResearch Manufacturing Division, is an industry leader in components and cooling systems for aircraft, missile and nuclear applications. This wide experience is now being offered to the electronics industry to provide a cooling package to meet any cooling requirement. Send us data in your problem or contact the nearest AiResearch or Aero Engineering office for further information.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

AERO ENGINEERING OFFICES:

PHOENIX: 1001 N. CENTRAL AVENUE, PHOENIX, ARIZONA 85004
LOS ANGELES: 4500 W. CENTRAL AVENUE, LOS ANGELES 45, CALIFORNIA 90013

AIRSUPPLY OFFICES:

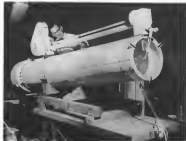
LOS ANGELES: 4500 W. CENTRAL AVENUE, LOS ANGELES 45, CALIFORNIA 90013
PHOENIX: 1001 N. CENTRAL AVENUE, PHOENIX, ARIZONA 85004



PAPER-THIN plastic Skyback follows lifting Stratoscope telescope and camera to altitude of 50,000 ft.



STRATOSCOPE photo of sea's surface taken from 50,000 ft. where camera was above 90% of the earth's atmosphere. Aperture equivalent area 300,000 sq. sq. ft.



UNIQUE 100 lb. solar telescope and camera (mounted rear) prior to high altitude flight.

Balloon Camera Gets 'Closeup' of Sun

New York-Shenpet pictures ever taken of the sun were obtained with a camera and telescope supported from a paper-thin plastic Skyback balloon (AW Oct. 10, 1955, p. 61) 50,000 ft. high, where they were above 90% of the earth's photo-distorting atmosphere.

Flight was first of a series called Project Stratoscope, being conducted for the Office of Naval Research.

Second flight was made on Oct. 17 over South Dakota.

Dr. Martin Schwartzchild, Eugene Higgins Professor of Astronomy, Princeton,

University, for whom the camera was built, hopes that the camera will produce photographs—expected to be three times clearer than possible with the most powerful earth-based telescopes—of the atmosphere turbulence in the sun's surface. Earth telescopes are hindered by the earth's atmosphere. Because of this interference, such those turbulent eddies on the sun's surface which are 600 mi. or more in diameter have been made indistinguishable in the past.

Stratoscope pictures are expected to

reveal the true size of these giant eddies as well as smaller local hot spots, solar flares and, ultimately, perhaps, long range radio disturbances arising from the sun.

Result will be collection of more long-expected data about the sun which will allow a better understanding of the heat sources on the sun's surface and its effects on the earth's atmosphere.

Specialty-designed Stratoscope telescope is 34 ft. long and weighs about 100 lb. Its primary element is a 12 in. aperture f 3.5 quartz mirror. The design,



Stratoscope camera (shown) will be used to photograph sun's surface from 50,000 ft. altitude. (Photo by Dr. Martin Schwartzchild, Princeton University, Oct. 17, 1955, p. 61)

Fenwal will help bring 'em back alive

Space men exploring Mars not only take along their own atmosphere — but bring it back. When voyagers "climate" you have to include "temperature" and when you say "temperature control" you can't be comprehensive without saying "Fenwal."

Since the Mars explorers will be gone some three years, reliability in temperature control is crucial, to say the least.

Fenwal, advanced engineering not only includes the imaginative,

but the practical, too. Fenwal's current work on thermostat sensing devices will be a good experience platform for space platforms. These designs already include, in their more far-flung, also temperature sensing" in aircraft and mis-

siles and protecting windshields from overheating.

To relax Fenwal's ability to help meet your present and future control problems, write Fenwal Incorporated, Aviation Products Division, Ashland, Massachusetts.



Controls Temperature . . . Precisely

although the camera will shoot 5,000 35mm photographs during a trip not more than 400 will be usable.

In addition to the telescopic-camera and its balloon-borne equipment, the project uses an automatic pointing control to keep the camera continually aimed at the sun. A parachute is included to return all the equipment safely to earth.

Low Coefficient of Expansion

Tube of the Stroboscope is made of Invar metal because of its very low coefficient of expansion which will maintain changes under the wide temperature extremes to which the instrument is subjected.

Turbine aids in cooling are 40,000 revolutions through the tube which permit air to circulate freely and avoid a chimney effect which might heat on air quality.

Prime contractor for the instrument-tube portion of the Project Stroboscope is Princeton University Observatory, which is directed by Dr. Leslie Spitzer, Jr.

Subcontractors for instrumentation are: Polymetech Corp., which designed and built the Stroboscope system and the Upper Air Laboratory (Department of Physics) and the Research Services Laboratories of the University of Colorado, which developed the automatic pointing control mechanism.

Air Force Funds

The Air Force Cambridge Research Center, Bedford, Mass. provided financial assistance for the entire instrument-tube portion of Stroboscope. Dr. John

W. Evans, Superintendent of the Smithsonian Peak Observatory, Benget, N. H., supervised the Air Force's activities.

Prime contractor for the balloon, instrumentation launching and recovery of the balloon and all equipment is the Ballous Department General Mills Inc., Minneapolis, Minn.

Dr. Salter, Dr. Bond, Dr. Physics Research and ECHSR Forward & Back, USN Air Search, are the three major project officers for the Office of Naval Research.

Project Stroboscope is a continuing phase of the program of upper atmosphere research began in the Office of Naval Research in 1940. Other continuing projects include Solohok (on stream), photo balloon light and the Stratoscope (measured) high altitude space laboratory.

Rocket Firm Building Two Static Test Bays

New facilities are being completed by General Control Rocket Co., Redlands, Calif.

Even in building two new static test bays on its 8,000-acre Redmond growing grounds, each capable of handling solid propellant rockets of 1,000,000 lb thrust. Other construction includes a 10,000 sq ft building and rocket in-situ building in aluminum building using and a propellant mixing building to accommodate a rocket can fuel chemical motor that will increase the company's solid propellant production to 1,100,000 lb per month.

Manufacturing at Marquardt



by
Roy E. Marquardt
President

Another barrier—the manufacturing barrier—is currently being penetrated by Marquardt engineers. What do we mean by manufacturing barrier?

Advanced designs for supersonic jet engines are coming from the drawing boards call for strength to weight ratios and high precision tolerances previously unobtainable. Now high-temperature alloys are meeting the metallurgical demands, but do not readily lend themselves to conventional machining and fabricating techniques.

Those members of the Marquardt team charged with pioneering new production methods comprise our Van Nuys Manufacturing Division. Here, under the direction of John E. Lirfeld—creativity and imagination go hand in hand with a thorough understanding of detailed shop problems to produce acceptable hardware, the management means that to do his best, while the engineer must be supplied with the most up-to-date tools of his trade.

Example: One our continuing efforts to cut out a specially designed, half-million dollar rail-former is being added to the company's ever-expanding production facilities. This machine will be capable of forming metal, titanium, stainless steel, and synthetic materials in a wide variety of cross-sections considered impossible or impractical to fabricate as a single piece. A completely new, clean-up view of the actual metal forming will be afforded the operator by means of two closed-circuit TV cameras mounted on the machine frame.

We are also acquiring other automatic machines—essentially controlled wire models of multiplying the output of their manually operated counterparts—thermal image duplicating, punched, and magnetic tape, these machines are expected to greatly expand the scope of Manufacturing Engineering.

Another of the modern production techniques at Marquardt puts in use modern nylon equipment for the construction of prototype engines.

At Marquardt, the engineer will find a broad range of machining equipments and the opportunity to further his career through supplemental educational programs.

Within this Division, engineering agencies exist for:

- General Engineering
- Thermal Engineering
- Two Engineers
- Aviation Engineering
- 10 Medical Device Engineers

For information about these positions and the professional engineering environment at Marquardt, we invite you to write Jim Dale, Professional Personnel, today.



To Manufacturing Engineers Facing an ENGINEER BARRIER *



John E. Lirfeld, Director Van Nuys Manufacturing Division

Marquardt Means Opportunity—Manufacturing engineers no longer need feel cynical because of the lack of up-to-date equipment. At Marquardt Aircraft—the company where an **ENGINEER BARRIER** has never existed—you will find the most advanced tools of your trade. Look to your future by looking to Marquardt today. Address your inquiries to Jim Dale, Professional Personnel, 2655 Gateway Street, Van Nuys, California.



* **ENGINEER BARRIER**—an achievement level beyond which you cannot advance



Trailer Services Sabre Fire Control

Cassidy Ltd. designed the control system steering vehicle to aid inspection, aiming and maintenance of Sabre aircraft in the field. Trailer four times wider, around other, new section of plane vehicle is equipped with wind break, storage shelves, doors and two 20 ft cables. Unit was built for the South African Air Force, three units are being constructed for the German Air Force.



Now

Alcoa offers strong, thin-wall precision castings

70 pounds saved in new interceptor fuel system

Aircraft engineers have found that exterior aerodynamic requirements and internal space limitations transform today's jet aircraft fuel systems into a planner's nightmare. Not only large orifices and tortuous passages through and around other systems/components have introduced the addition of scores of elbows and connecting fittings to supply a constant flow of fuel to the power

plant. Until now, each additional fitting carried an unmovable weight penalty.

Now, thanks to new Alcoa precision casting techniques, the fuel tank fuel system fittings used by one major aircraft company weigh 30% less than they formerly did as steel castings. They perform better, too. Please visit, in alloy 505-T6 with a wall thickness of .060 in. and

a tolerance of plus or minus .015 in., these parts satisfy a new standard in aircraft fuel line castings. Not only are they half the thickness previously considered minimum, but the tolerance itself has been halved. Although specifications still call for impregnation of these parts for fuel system service, they have thus far passed porosity tests without it. In fact, these lighter castings compare favorably with the soundness and strength of permanent-mold castings.

Savings up to 20% in time and money were realized by this company when it was discovered that the precision and consistency inherent in the fittings made it unnecessary to prepare expensive adjustable gage and fixture setups for finish machining operations. For the complete story on how this new development in casting techniques can benefit you, call your Alcoa sales engineer. He'll be glad to work with you in developing sound, lightweight castings that can save port area and money. Aluminum Company of America, 3305-W Alcoa Building, Pittsburgh 19, Pa.



Your Guide to the Best in Aluminum Value



THE ALCOA 100th — Celebrate the First Low Stress, Aluminum Safety Envelope

Camera Ready to Track Soviet Satellite

By Russell Hawley

South Pasadena, Calif.—First of 13 tracking cameras attached as part of the satellite tracking network to JGV Project Vanguard has been hoisted into service in the backdrop of an assembly plant here to track the first Russian satellite.

The specially designed three-ton camera is operating in a simple observation, originally intended only for testing of completed cameras before they were shipped to their assigned stations.

First camera was to have been sent to a prototype satellite tracking station at White Sands, N. M., for intensive shakedown trials. Its final assembly was completed several days before the firing of the Russian satellite but there was no time to ship it to a regular tracking station. An attempt was made last week to track the satellite, but rocket stage after it was launched the rocket was sufficiently brighter than the satellite itself to be tracked in daylight. Attempt failed because of cloud cover.

First good tracking observations are expected early this week.

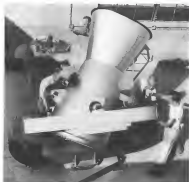
Satellite Tracked at Dusk

Satellite can be tracked only in twilight because after it is launched it is eclipsed by the earth and during the day it is obscured by daylight. Presence of its orbit due to observation of the earth and concentration of stars over the equator will bring the satellite across the western part of the U. S. every day for a period of time in the day while it is in the twilight zone, after which it will not be observable for perhaps 40 days. When Vanguard is fired it is expected to be observable for about 15 days out of 30. Dr. Karl G. Hinner of the Smithsonian Astrophysical Observatory, who is in charge of optical tracking of the satellites, doubts that the Russians planned to make it difficult for the satellite to be tracked from this country. He points out that the usual tool to be planned for frequent earth observations from Russia for these to evaluate the launching.

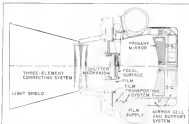
Satellite Tracking Methods

There are three chief means of satellite tracking: radar, visual and photographic. The Smithsonian Astrophysical Observatory was assigned responsibility for the latter two—Optical Mass watch and the 12 station photo tracking net. Radar tracking will be handled by the Naval Research Laboratory's Menlo Park system.

Optical system for the Smithsonian



THREE TON tracking camera is operating in a simple observation, originally intended only for testing of completed cameras before they were shipped to their assigned stations. First camera was to have been sent to White Sands, N. M., for shakedown trials, but actual was set up to track satellite rocket.



OPTICAL system consists of a 10-in. dia. spherical mirror and a 28-in. dia. correcting plate with three lens elements using a different type of glass in the outer element. Chromatic aberration is reduced to less than three thousandths of an inch. Camera speed is 1/250. Film speed is 9,000 miles per second.

When aircraft design calls for DEPENDABLE ACCESSORY POWER...



AIRCRAFT
BLOWERS

ALTERNATOR
COILS

MOVING
BLOWERS

Industry specifies **PROPULSION RESEARCH CORPORATION** pumps • compressors • turbines

Today's advances in aircraft performance have created a critical need for new concepts in accessory power. It takes specialized power — hydraulic, electrical and mechanical — to guide the layers of air on supersonic windmills of high speed jets... to control the banking of supersonic aircraft... to meet ever more complex electrical system requirements... to cool hot surfaces.

Such power is the business of Propulsion Research Corporation, a subsidiary of Curtiss-Wright Corporation. PRC accessories are setting new standards of performance, precision, efficiency and dependability in both aircraft and missile applications. Design, development and manufacturing activities are consolidated in a smoothly integrated department, able to produce efficiently and economically to the most stringent requirements of both commercial and military specifications.

Illustrated are three typical products manufactured by Propulsion Research — products that are contributing importantly to some of the most advanced aircraft in the skies today.

PROPULSION RESEARCH CORPORATION
A CURTISS-WRIGHT
CURTIS-WRIGHT
CORPORATION SANTA MONICA, CALIFORNIA

casualties were dropped to 131. James Baker of Harvard University and cousin to the Paris-Rhône Corp., Norfolk, Calif.

The entire structure and its mechanical design were conceived by Joseph Nanni and built by Baker and Clavens Inc. here. Dr. Hanner said he believes it is the only system in the world designed specifically for precise tracking of satellites. He said the Russians would not require such a device since the United States has announced its intention to build a photo tracking system and release the data it gathers to anyone who is interested.

Problem in antenna design was how to receive faint light from satellite coming at an angle of refraction of as much as 1.5 deg. per sec. Hanner said now inside of the satellite is about 5. This is about 4 the brightness of the satellite star perceptible to the naked eye.

Some Angular Velocity

Astronaut tracking mechanism is designed to mount the antenna at the same angular velocity as the satellite, making longer exposures possible without blurring and allowing of simple satellite is located precisely in its relation to background stars in the picture those measurements are well known. Background stars and satellite cannot be shown at points in the same exposure because of different angular velocities.



Barrel Rack

Flare barrel racks are designed to allow standard lift trucks to handle and stack loaded or empty barrels and drums. Also making the need for special down-handling equipment, the racks are so ready that fork lifts can pick up two drums from front, back or either side. Units also make it easy to get at humped drums too. Close stacked racks will support 7,500 lb. in 15 high drums and 14,000 lb. in 16 high drums. Manufacturer: Pinner Steel Drums Co., public Steel Corp., 5180 Tronzo Ave., Cleveland, Ohio.



707 Assembly Progresses

Forward fuselage section for the first Boeing 707 jet Stratosliner is shown in construction at Boeing Equipment Division, Renton. Work Number one airplane is nearing completion on final assembly line. Two American World Airways will be the first airlines to receive the jet transports; delivery is scheduled for late 1958.

Wherever aircraft
are serviced...
Wherever airplanes
are built...

WEBER

Aerostand

- Service aircraft
- Upgrades
- Maintenance
- Data recording



WEBER AIRCRAFT CORPORATION
2625 Ontario Street, Dayton, Ohio 45424

JUST
ARRIVED



"CLEVELAND
(AT AIRWORK, OF COURSE)

SPR. ELIMINATED LAST YEAR. FROM SPARE PARTS DELIVERIES OF SPARE PARTS. FROM MORE THAN A DOZEN MANUFACTURERS. INCLUDING ALL THE BEST KNOWN NAMES IN ENGINES AND ACCESSORIES.

Just call Cleveland 1-5521 and ask for Bob Scott in Royal Station. Or write: Building No. 10, Cleveland (Shaggy) Airport, Cleveland 17, Ohio.

1958 record from parts are kept.

Airwork
CORPORATION

ALEXANDRIA • CLEVELAND
ATLANTA • MIAMI • NEWARK

40 years
and
1,060,744
KVA
later...



USAF B-58 "Hustler", America's first supersonic bomber. General Electric, General Dynamics Corp., Fort Worth, Tex.



Westinghouse equipment for B-58: (1) Six-cylinder Constant Speed Drive and Water Pump; (2) 45-KVA Reaction-Governed Generator; (3) Regulator-Control Panel; (4) Transfer Controller; (5) Control Transformer Assembly.



First airborne generator, shown on Billy Mitchell's Spad 16. Photo: Courtesy of The Smithsonian Institution, Washington, D.C.

Westinghouse is still the leader in airborne electrical power!


From the single-blade, wind-driven Westinghouse generator shown, shown on Billy Mitchell's Spad 16, to the amazing electrical components of Convair's supersonic B-58 "Hustler", in an epoch in air power.

And it's an epoch Westinghouse helped pioneer with 1,060,744 KVA of service to the aviation industry.

For Westinghouse and the aviation industry have been partners in progress since 1917. The first airborne a-c generator, the multi-

generator parallel a-c system and today's fully protected automatic system are just a few of the milestones.

The facilities of the Aircraft Equipment Department, at Lima, Ohio, have been at the disposal of the aviation industry for years. They're at your disposal, too. Why not use them?

YOU CAN BE **SURE**—IF IT'S Westinghouse 
Aircraft Equipment Department • Lima, Ohio

two run one to the other to appear as a trail. Solution embodied in Babcock-Norton system is to facilitate the tracking mechanism speed between satellite vehicles and the component of subsonic motion of background stars parallel to satellite orbit. A double exposure showing first the satellite and then the background stars in pairs allows precise determination of position. Misalignment of the satellite between exposures can be calculated from the distance between point and trail and the known time between exposures.

Cylindrical camera consists of a 30-in. dia. spherical camera and a 20-in. dia. viewing plate with three lens elements using a different type of glass in the center element. Camera shows various views, adjusted to one of three different wave lengths. Camera speed is 1/10.

Wave speed is 0.005 meter-candle-seconds. Film frames constant 2 in. x 12 in.

Oblique field of the camera covers 18 deg. in its long axis by 5 deg. in its short axis.

Camera is Gimbaled

There is no provision for locking the camera on its target or for making out camera angles from shift positions. The camera is gimbaled and rotates on three axes, but is clamped in two. All active tracking is carried out on the third.

It is set up to track automatically along a geodesic orbit. Obviously, the predicted orbit must be close to the real one or no picture will be recorded.

To this extent the value of the camera is dependent on radio tracking, or some other means of getting an approximation of the satellite's orbit. Once given an acceptable approximate view, the camera can locate the satellite within 2 sec. of arc and 0.001 sec. of time.

Need Three Shots

It's got a picture fix as the satellite requires three good shots from two positions.

This should pose no problem since Convair is considerably east of getting at least three good shots from a camera in one passage of the satellite.

Velocity in the height of the orbit will indicate something of atmospheric density at that level. Altitude is now estimated at 300 mi. Velocities in the angle of the orbital plane will indicate the slope of the earth and the deviation from its axis. When the position of the orbit is accurately known it will be possible to calculate observer between stations on different continents to an accuracy within 30 ft.

This is about 1/3 the error in past calculations.

ENGINEER OPPORTUNITIES AT RAYTHEON



SUPPLIER NAVIGATION EQUIPMENT is tested for flight testing under operational conditions. Engineers at the Maynard Laboratory hold magnetic tape for program from actual study phase through prototype production.

Newly formed project groups solve complex airborne radar problems

Engineers like the project-type organization at Raytheon's Maynard Laboratory. It gives them maximum diversification in their work on the most advanced radar navigation and control problems of the day.

At Maynard, you'll find projects involving many areas of aircraft navigation and guidance systems... doppler navigation, velocity check systems, night fighter operations systems, flight-control systems, altimeters. There is also interesting new work on countermeasures equipment.

Career opportunities for men at all levels now exist in the following areas:

- | | |
|----------------------------|--------------------------------|
| ADVANCED CIRCUIT DESIGN | HEAT TRANSFER ENGINEERING |
| ELECTRONIC PACKAGING | SPECIFICATIONS WRITING |
| ANTENNA DESIGN | TECHNICAL WRITING |
| MICROWAVE COMPONENT DESIGN | SYSTEMS ANALYSIS & ENGINEERING |

For complete details on engineering positions in any of Maynard's project groups, please write John A. Oliver, P.D., Box 87A, Raytheon Maynard Laboratory, Maynard, Mass.

RAYTHEON MANUFACTURING COMPANY Maynard, Massachusetts

Are you the
ONE MAN IN THERE?



MAYNARD LABORATORY

Excellence in Electronics

FROM VUGHT ENGINEERS . . . NEW SPEED, NEW SAFETY IN A HINGED WING

Profile of a New Approach to a Carrier Landing

As he whistles in for a carrier landing, the Crusader pilot has the full forward visibility he so vitally needs. Up above the clouds, he has the slanting, 1,000-
mph-plus speed that assures air superiority.

By all that governs carrier fighter design, he should be certified only to one or the other of these two features. But Vought engineers conceived a variable incidence wing which enables the Crusader to give him both.

They developed a continuous wing, attached to the Crusader fuselage by pivot hinges at the trailing edge and by a hydraulic strut near the leading edge. Prior to landing, the wing may be tilted into desired

approach attitude. The fuselage, meantime, remains almost horizon-level—and the pilot has a straight-on view of landing signals and the incoming deck.

By achieving full approach visibility without elevating the pilot seat, Vought engineers have kept the Crusader canopy sleek, simple, sleek. This minimizes fuselage drag, and is a major factor in the Crusader's Thompson Trophy-winning speed.

Typically, the Crusader's developers approached their assignment with firsthand operations analysis, completed it with technical free-thinking. Again, they came up with an original weapon . . . and an important new concept as well.

Weapon System Development at Vought

Successful weapon systems and well-rounded engineers have a common denominator at Vought. It's the "project-group" system, a highly effective brand of development teamwork that makes each engineer an inside man on the over-all development picture.

On the Crusader fighter, the system worked like this:

Engineers selected from their home groups for the Crusader project followed their assigned systems and subassemblies from preliminary design to flight test. Teamed with engineers from other groups, they gave mutual assistance and enlarged their own view of the program.

At the same time, liaison was maintained with the home groups on methods, research and policy. This way, the state of the art was coordinated with the practical problems of project work. Engineers of one specialty, working with those of another, reached better compromises, developed a wider view.

Whether you are an experienced project man, a technical specialist, or a junior engineer, you, too, will appreciate project-group advantages.



Turn tax savings into buying power

You can do it in Dallas—where there's no state income tax, no bond or state sales taxes. Low school and property taxes and a lower state cost of living add to your savings on your budget for life.

CHANGE
VOUGHT AIRCRAFT
INCORPORATED • DALLAS, TEXAS



between the terminal and the terminal. Right now, Carter Field is operating at less than full capacity, although traffic has been growing. Passenger traffic increased 46% between the first half of 1974 and the first six months of this year. In the same period, airline schedules increased 55% and aircraft operations increased 90%.

Carter Field has operated at a profit since December, 1975, and current profits are running \$6,160,000 a month. Profits are applied against the terminal expansion's \$74,000 loan, which will be retired by 1982. After the loan is paid off, profits are to be split between the companies and Ft. Worth.



... from fractional amps

to landing lamps...



If it's an aircraft lamp, G. E. makes it!

No matter how big or how small a lamp you might need, if it's an aircraft lamp, General Electric makes it! You can get General Electric Aircraft Lamps in a wide range of sizes, types and wattages... from your nearby General Electric Lamp Distributor. And you can get them fast! He stocks a full line of G-E "sub-miniature" lamps, for instance—the

smaller-than-small lamps. And he also carries big lamps—the landing lamps for all types of aircraft.

Whatever you need, it's an aviation lamp, General Electric makes it... and your G-E Lamp Distributor can get it for you fast! Call him today—or write: General Electric Co., Miniature Lamp Dept. J99-4-7, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Self-Contained Shelf Designed for Jetliner

New integrated electronic rack and shelf units will be installed below deck in the Conquest 500 jet transport. Designed by Robinson Avionics, Inc.'s, West Coast engineering office, Santa Monica, Calif., the equipment fortifies a shock and vibration isolation arrangement with MenI-Flex resilient mounts. As installed in the Conquest 500, the shelf system will support a total equipment weight of about 100 lb.

Each shelf, incorporating an area warning and protection box with quick dis-

connects, can be removed in less than a minute for replacement or repair services. Between the optional cooling duct and shelf plenum chamber there is a shock-joint junction to speed removal. If caught in cases of gravity of re-division, some of equipment is changed, there is a continuous effort on the overall supported mass, hence there is no need for changing load ranges on the shock-isolation system.

Length of the Conquest installation is 43 in., height 10 in., depth 23 in.

Some aspects, devised by Robinson, are used in North American Avionics' new 44-in. transport/bomber resistance trainer. Subsequent, a rack uses a single integrated shelf installation.

Research also is interested in the integrated electronic rack and shelf units for its T87 jet transport.

Los Angeles Initiates Runway Construction

Marking the \$400-million construction step in a planned multimillion dollar expansion of Los Angeles International Airport, the Board of Airport Commissioners last week let bids for construction of a new 4,000-ft runway and taxiway system.

Known as Complex 1, the project will cost more than \$2 million, will include an 8,915 ft runway and associated taxiways. Generalbuilding is slated for the last work in the complex. New runway will span 3,000 ft at the airport, is providing simultaneous landings and takeoffs in conjunction with present dual runways.

Unprepared for Jets, CAB Official Warns

San Valley, Idaho—John W. Driggs, Civil Aeronautics Board member, warned the aviation industry that it is too complacent toward problems posed by the approaching jet age. This complacency, he said, is not only heightening, it approaches the tragic.

Speaking at a meeting of the National Association of State Aviation Officials, Driggs said, "It's not too far up the list that all the recent time we've spent preparing for the problems it presents and time is running out on us."

The CAB official pointed out that in a little more than a year deliveries of jet aircraft to airlines will begin. In the same, he said, there will be about 10% jet aircraft operating over domestic routes, and, by 1980, there will be a total of 275 turbine engine transports in operation.

But, he added, "what have we done to prepare for that revolution in air transport, a revolution as pronounced as when we stepped from the Model T

WEIGHS ONLY 22 POUNDS —DELIVERS 1.7 KVA

New Aeroproducts air-driven generator supplies emergency power in Douglas A3D and A4D

Now flying in the Navy A4D carrier-based bomber and scheduled for later versions of the A3D, this new Aeroproducts air-driven emergency generator provides the highest power-to-weight ratio of any unit of its type. Also capable of generating power for tow-target towing mechanisms, this compact, lightweight generator develops 1.7 KVA @ 12,000 rpm—provides adequate emergency power to operate lights, radios, instruments, trim tabs and elevators.

The same engineering know-how which has made Aeroproducts the leading designer and producer of turbo-propellers is available to assist you with the design, development and production of any air-driven generators and hydraulic pumps, actuators and other air-borne accessories.



Using a simple Made pitch-changing mechanism, the Aeroproducts ram air-driven emergency generator gets up to speed in less than 1/100th second—provides an output frequency between plus 10% and minus 5% over a wide range of air speed, altitude and load conditions.

For detailed information on how Aeroproducts can assist you with your aircraft accessory designs, write us your complete information for 20-page brochure, "Aeroproducts for Aircraft" and send design catalog, "Aeroproducts Ram Air Accessories."

Building for Today...Designing for Tomorrow

Aeroproducts

AIRBUS DIVISION OF GENERAL MOTORS • DAYTON, OHIO



SIMMONDS PACITRON CONTROLS FUEL MEASUREMENT AND MANAGEMENT ON THE CONVAIR 880

Simmonds PACITRON systems have been specified for the Convair 880, now jet transport which will soon be in service carrying more payload for the world's leading airlines. The PACITRON Fuel Gauge System was chosen because of its light weight and successful record of reliability and accuracy.

In addition to accurate fuel measurement, the dependable PACITRON System can also provide control of fuel management functions such as:

Level Limit Control—automatic control of fuel taken aboard vs. accordance with flight plan.

Totalling—giving of total fuel weight on board the aircraft.

Center of Gravity Control—automatic control of the distribution of fuel.

Level Switching—in means of providing signals in predetermined levels for control of valves and pumps.

The installation of PACITRON on the Convair 880 is continuing proof of Simmonds' leadership in "first in electronic fuel gauging."



Simmonds AEROCESSORIES, INC.

General Office: Long Beach, New York

Branch Offices: Baltimore, Maryland • Dayton, Ohio • Washington D.C. • St. Louis, Missouri • Wichita, Kansas • Cleveland, Ohio • Seattle, Washington • San Francisco, California • Toronto, Ontario • London, England • Montreal, Quebec • Mexico City, Mexico • Lima, Peru • Bogota, Colombia • Santiago, Chile • Lima, Peru • Lima, Peru

age to the high compressions, modern automobile of today.

Dragage had experts already at work on technical problems such as air traffic control, navigational aids and operational problems but that his primary concern is with the economic aspects of air transportation in the jet age.

The loading of passengers and their baggage, the adequacy of airport terminal facilities and the effect of jets upon the air service pattern and interconnectivity, local and feeder services are some of the problems he outlined as needing considerable attention.

The scheduled airline's capacity of 15,000 seats in 1958 will be increased by about 100% by 1968, Dragage said. He added that it is the responsibility of everyone in the industry to develop new thinking and planning to meet the challenge and 53 these additional seats.

How many of our airports today are capable of handling these jet aircraft carrying 128 to 150 passengers from the passenger service point of view?

In our already congested terminal buildings, how many airline ticket counters could check in one thousand of 150 passengers, not to mention the problem of loading 150 passengers at the ramp?

"Baggage handling today is one of the most distressing problems in the air transport industry. What are we going to do when a jet aircraft dumps the baggage of one or more planes carrying 150 passengers each into one inadequately baggage handling facilities? How many airports today can adequately handle the airframe transportation problems from the airport to the city?"

He also said it is safe to assume that jet aircraft probably will have a cruising stage length of at least 500 miles in which they can operate efficiently, resulting in changing service patterns.

"This will mean that more of our important traffic gathering points that are located near another major traffic generating point may not receive jet service," he said. "Much importance will be attached to the feeder type of air service either by one intermediate carrier or by our local service carrier."

The CAB routes division chief also predicted a greater need for the intermediate and feeder type of service than in the immediate future.

"I cannot help but feel," he said, "that the local service industry within the next 10-year period will really come into its own. They are today serving a most important segment of our air transport requirements. I firmly believe that the importance will become increasingly greater and that their feeding traffic into the major trunklines for the longhaul service will be an even more vital part of our air service pattern."

HOW CALIDYNE CAN HELP PROTECT YOUR VIBRATION TEST INVESTMENT



CALIDYNE SYSTEMS ARE CUSTOM BUILT

For years, Calidyne has been building Vibration Test Systems for most types of military, scientific, engineering and industrial equipment. Most Systems have been custom-designed for special applications. Although they were representative of the most modern equipment available at the time, it may now be to your advantage to modernize to meet the current requirements of the latest testing field.

HOW TO OBTAIN CONSIDERANCE

Some of the older Calidyne Vibration Test Systems may have become obsolete or a plant where they cannot be expanded to meet many modern requirements. With Calidyne, it is possible for us to upgrade the equipment so that its performance will compare favorably with any new being offered. In many cases this can be done without serious modification of the original framework.

IT MAY PAY TO INVESTigate

When you want to investigate the possibility of upgrading your Calidyne Vibration Test System, get in touch with us here at Calidyne. We can quickly tell you what may be done. The address: Calidyne in Washington (District) 6-0830, or write.



CALIDYNE
CORPORATION
100 FIRST STREET, WASHINGTON, DISTRICT OF COLUMBIA

Engineers: MAKE AVIATION HISTORY AT RYAN

THE NEW X-15 VELOCITY is another example of the boldness and daring that Ryan is known for in aviation. You'll find the same high level of advanced engineering in every plane of Ryan's work.

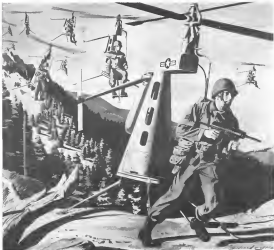
- VTOL aircraft (jet and turboprop)
- Automatic Navigation
- Missile Guidance
- Rocket Combustion
- Jet Engine Metallurgy
- Drone Missile Design

Ryan is the right man for you. Big enough for complete responsibility on challenging projects...small enough so you won't get lost in the shuffle. And Ryan is located in clear sky San Diego, world-famous for beaches and annual flying.

For complete details, write to: JAMES RYAN

RYAN AERONAUTICAL
CORPORATION
2340 Harker Blvd., San Diego 12, California





World's smallest gas turbines to lift a sky full of men

MAXIMUM AIRIAL MOBILITY is an important aim of America's military forces. Solar advanced technology is helping to realize this goal by designing the smallest gas turbine aircraft engine ever built. The 86 hp Titan engine, weighing only 90 pounds, will power one-man helicopters like those pictured in this artist's conception, as well as flying platforms. It represents an important addition to Solar's growing family of gas turbine engines.

For over a decade Solar has been a world leader in the design, development and production of small-size gas

turbines. Current production models—the 30 hp Mini® and 500 hp Jupiter®—are being turned out in volume for a wide range of military and commercial applications. Uses include portable power generation for industry, aircraft support, boat propulsion and others.

Compact and lightweight, simple in design, Solar gas turbines offer many advantages over conventional power plants. They start instantly in severe temperature extremes, require a minimum of maintenance and can be operated on a variety of fuels. Perhaps one

of these versatile engines can solve your power problems. Write today for a new gas turbine brochure: Dept. D-195, Solar Aircraft Company, San Diego 23, Calif. Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engine, airplane and missile components.



DISCOVER THE WORLD'S Coldest atmosphere, challenging projects, good living with Solar! Send for our brochure.

Lufthansa Crosses \$19 Million in 1956

Rome, Germany—Lufthansa-Gesellschaft posted \$19.16 million with a net loss of \$4.77 million during 1956 in its first full year of post-war operations according to the airline's annual report. Deficit for 1955 was \$5 million. Losses are government subsidized.

Operating expenses for 1956 were \$24.97 million. The airline carried 230,678 passengers, up from 186,000 in 1955 with a passenger load factor of 62%.

Lufthansa also tripled its route miles in 1956 to a total of 23,800. Big expansion during the year included inauguration of service to North and South America, Alaska and Asia. Next year the carrier plans to add Rome to its European network, and in 1958 '59 to add Oslo, Stockholm, Helsinki, Rangoon and Amsterdam. In 1959, plans call for extension of West East service to Canton and in 1960 Lufthansa expects to begin daily service to Katsuji on a Tac East route that will eventually include India, Bangkok, Singapore, Manila, Hong Kong and Tokyo.

To date, the carrier's route miles total 77,500. Fleet now comprises eight Lockheed Super C Constellation for Concor 440, four Concor 140s and three DC-7s. Delivery of first of four 1600A Constellations has been taken and the airline has four Boeing 707s and one Lockheed SR-70B on order.

California Legislates On Aviation Measures

The California Legislature has taken a number of actions affecting the aviation industry, including the following:

- Voted \$87,079 for the support of the California Aeronautics Commission for the first year beginning July 1st, as increase of 56% in the commission's operating program. Included is \$18,640 for the purchase of a new airplane to replace one lost in a crash in 1955.
- Passed in SB 1 a law for the gas for commercial vehicles after expiration while standing waiting.
- Approved legislation authorizing cities to sell or lease for a term of not exceeding 25 years with an option to purchase, an municipal airport in 400 parcels owned for airport purposes or purposes incidental to airport.
- Amended various sections of the Public Utilities Code, affecting its special measure of airport projects.
- The changes were designed to guarantee the airports protection. As an example, one is intended to give the aeronautics commission power to take

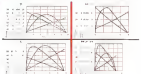


KEY SOURCE FOR SMALL MOTORS

Global Industries should be your prime source for small, peak performance A.C. and D.C. motors for fundamental operations. For instance, the four D.C. motors shown are just a beginning—not only can you have them in countless variations, but you can add ratios of standard spur or planetary gear ratios. Also, a wide variety of governors, clutches and filters are available promptly to meet any need you have. All these variables are combined by Global to give you a motor which not performs any other motor of comparable size.

As interchangeable standard part drawings, coupled with precision production techniques to reach engineering efficiency are specific reasons why you can obtain quickly custom built prototypes in 2 to 4 weeks. These same methods shorten lead time on Globe assemblies, timers, rate gyros, blowers, servos.

Ask the largest D.C. miniature motor manufacturer first. Send for your copy of the Globe D.C. motor catalog now. Global Industries, Inc., 1794 Broadway Avenue, Dayton 4, Ohio 45424.



STANDARD CHOICES: voltages in 320 V.O.C. motor in 1/20 sec. 120 sec. and planetary gear ratios, gearset from many series in 2500 or 3000, many varieties of governors, clutches, brakes, and filters are available. The graphs appearing above illustrate typical performance.



Cool Performance In A Hot Engine



Major U. S. manufacturers of jet aircraft engines have learned to depend on American Welding rings and conical components of stainless steel, titanium or other special alloys to solve many of the problems caused by the requirements of today's supersonic performance. American Welding is recognized as laser, weld, fabricate and machine rings and weldments from 6" to 96" in diameter.

Why not contact American Welding's Industrial Products Division to talk about rings and components where top performance is required?

THE AMERICAN WELDING & MANUFACTURING CO.
420 Erie Road • Warren, Ohio

AMERICAN WELDING

The World's Leading Manufacturer of Welded Rings

area of airport landowners' vehicles used exclusively interfacing with the operation of an airport.

Another piece of legislation passed requires the State Department of Public Safety to aid and assist local school districts in the development and conduct of a program of aviation education. The bill requires the Transportation Commission to aid in the selection of reports and plans and by local school districts in flight instruction and instruction. The commission also is authorized to make available to public schools offering actual flight experience, a basic aviation program and to cover that adequate supervision and proper flight maneuvers as taken in the flight school operators contracted to provide services for public school students. This measure provides for aviation experiences in junior high schools in the area of local studies science and instruction, and actual flight experience in the high schools where appropriate, reports, plans and pilots are available.

The State Senate approved the creation of an aviation committee of this nature with an appropriation of \$7,500 to study aviation problems like aviation creating the committee, parents met.

The aviation industry in a whole, is now the target of various industry within the State of California.

It is vital in the process of the state that the legislature be fully informed as to all facts relating to aviation and the aviation industry, and all problems connected therewith, so that legislation affecting and aviation can be intelligently considered by legislators having special knowledge in aviation and aviation.

The committee is authorized and directed to ascertain, study and make all facts relating to the subjects as passed in the course of this resolution including, but not limited to, fact-finding to aircraft manufacturing, civil or transportation, scheduled and unscheduled air carriers, flight test operations and maintenance and general aircraft operations, civil and military airports, aviation industry, or generally, aviation, agricultural aviation, welding, crop dusters and aviation and forest management and forested, and wildlife management, the use of aviation in civil defense, foreign and domestic commerce and in a host of government aviation education in the public schools and by other means and the California Aeronautics Commission.

The legislature reported a proposal to give public aviation, aviation education of land to be considered for reports. The lawmakers also passed down proposals to make an overall financial responsibility law and to raise money for public aviation maintenance and construction.

Only degreasing solvent with DUAL ACCEPTANCE



NEW DETREX

PERM-A-CLOR (NA)

(TRICHLOROETHYLENE)

New, Dual Acceptance™ means greatly increased efficiency and economy for solvent degreasing operations because PERM-A-CLOR (NA) contains dual acceptance that assure a new high degree of solubility, functioning in both the presence and absence of moisture, flume and emulsifier also provide outstanding resistance in the widest range of industrial soils on any metal or combination of metals.

Through higher solubility, PERM-A-CLOR (NA) can be used, distilled and reused with minimum loss strength. The number of parts degreased per pound of solvent is greatly increased, while solvent loss is cut to a minimum. Carry-down loss for maintenance is reduced because of PERM-A-CLOR (NA) reusability, low life liability.

Complete DETREX facilities include—degreasing systems—steel cleaners—acid cleaners—phosphate conversion coatings—degreasing equipment and industrial washers—ultrasonic cleaning machines—specialized technical counsel and engineering field service.

PERM-A-CLOR is a registered trademark of

DETREX

CHEMICAL INDUSTRIES, INC.

BOX 591, DETROIT 27, MICHIGAN



EMPLOYMENT OPPORTUNITIES

The following are the active listings of openings in the aerospace industry, including related services, as of October 25, 1957.

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

EMPLOYMENT

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

Flight Test
Research
Design

Structural Design
Electronics
Manufacturing

Engineering
Research
Design

pilot

with commercial airline experience for flight position of automatic controls and flight director systems to commercial airlines and owners of private aircraft.

Should have piloting experience in the single engine and multi-engine aircraft that are based outside of the military.

It is desired that applicants be familiar with the various flying and pilot's organizations.

Please send full resume of your background with your first letter to:

Public, Aviation Week
 One, July 20, 1957, Box 15, N.Y. 20, N.Y.

Public, Aviation Week
 One, July 20, 1957, Box 15, N.Y. 20, N.Y.

POSITIONS WANTED

Senior Transport Pilot, type ratings in Douglas C-124, C-125, C-126, C-127, C-128, C-129, C-130, C-131, C-132, C-133, C-134, C-135, C-136, C-137, C-138, C-139, C-140, C-141, C-142, C-143, C-144, C-145, C-146, C-147, C-148, C-149, C-150, C-151, C-152, C-153, C-154, C-155, C-156, C-157, C-158, C-159, C-160, C-161, C-162, C-163, C-164, C-165, C-166, C-167, C-168, C-169, C-170, C-171, C-172, C-173, C-174, C-175, C-176, C-177, C-178, C-179, C-180, C-181, C-182, C-183, C-184, C-185, C-186, C-187, C-188, C-189, C-190, C-191, C-192, C-193, C-194, C-195, C-196, C-197, C-198, C-199, C-200, C-201, C-202, C-203, C-204, C-205, C-206, C-207, C-208, C-209, C-210, C-211, C-212, C-213, C-214, C-215, C-216, C-217, C-218, C-219, C-220, C-221, C-222, C-223, C-224, C-225, C-226, C-227, C-228, C-229, C-230, C-231, C-232, C-233, C-234, C-235, C-236, C-237, C-238, C-239, C-240, C-241, C-242, C-243, C-244, C-245, C-246, C-247, C-248, C-249, C-250, C-251, C-252, C-253, C-254, C-255, C-256, C-257, C-258, C-259, C-260, C-261, C-262, C-263, C-264, C-265, C-266, C-267, C-268, C-269, C-270, C-271, C-272, C-273, C-274, C-275, C-276, C-277, C-278, C-279, C-280, C-281, C-282, C-283, C-284, C-285, C-286, C-287, C-288, C-289, C-290, C-291, C-292, C-293, C-294, C-295, C-296, C-297, C-298, C-299, C-300, C-301, C-302, C-303, C-304, C-305, C-306, C-307, C-308, C-309, C-310, C-311, C-312, C-313, C-314, C-315, C-316, C-317, C-318, C-319, C-320, C-321, C-322, C-323, C-324, C-325, C-326, C-327, C-328, C-329, C-330, C-331, C-332, C-333, C-334, C-335, C-336, C-337, C-338, C-339, C-340, C-341, C-342, C-343, C-344, C-345, C-346, C-347, C-348, C-349, C-350, C-351, C-352, C-353, C-354, C-355, C-356, C-357, C-358, C-359, C-360, C-361, C-362, C-363, C-364, C-365, C-366, C-367, C-368, C-369, C-370, C-371, C-372, C-373, C-374, C-375, C-376, C-377, C-378, C-379, C-380, C-381, C-382, C-383, C-384, C-385, C-386, C-387, C-388, C-389, C-390, C-391, C-392, C-393, C-394, C-395, C-396, C-397, C-398, C-399, C-400, C-401, C-402, C-403, C-404, C-405, C-406, C-407, C-408, C-409, C-410, C-411, C-412, C-413, C-414, C-415, C-416, C-417, C-418, C-419, C-420, C-421, C-422, C-423, C-424, C-425, C-426, C-427, C-428, C-429, C-430, C-431, C-432, C-433, C-434, C-435, C-436, C-437, C-438, C-439, C-440, C-441, C-442, C-443, C-444, C-445, C-446, C-447, C-448, C-449, C-450, C-451, C-452, C-453, C-454, C-455, C-456, C-457, C-458, C-459, C-460, C-461, C-462, C-463, C-464, C-465, C-466, C-467, C-468, C-469, C-470, C-471, C-472, C-473, C-474, C-475, C-476, C-477, C-478, C-479, C-480, C-481, C-482, C-483, C-484, C-485, C-486, C-487, C-488, C-489, C-490, C-491, C-492, C-493, C-494, C-495, C-496, C-497, C-498, C-499, C-500, C-501, C-502, C-503, C-504, C-505, C-506, C-507, C-508, C-509, C-510, C-511, C-512, C-513, C-514, C-515, C-516, C-517, C-518, C-519, C-520, C-521, C-522, C-523, C-524, C-525, C-526, C-527, C-528, C-529, C-530, C-531, C-532, C-533, C-534, C-535, C-536, C-537, C-538, C-539, C-540, C-541, C-542, C-543, C-544, C-545, C-546, C-547, C-548, C-549, C-550, C-551, C-552, C-553, C-554, C-555, C-556, C-557, C-558, C-559, C-560, C-561, C-562, C-563, C-564, C-565, C-566, C-567, C-568, C-569, C-570, C-571, C-572, C-573, C-574, C-575, C-576, C-577, C-578, C-579, C-580, C-581, C-582, C-583, C-584, C-585, C-586, C-587, C-588, C-589, C-590, C-591, C-592, C-593, C-594, C-595, C-596, C-597, C-598, C-599, C-600, C-601, C-602, C-603, C-604, C-605, C-606, C-607, C-608, C-609, C-610, C-611, C-612, C-613, C-614, C-615, C-616, C-617, C-618, C-619, C-620, C-621, C-622, C-623, C-624, C-625, C-626, C-627, C-628, C-629, C-630, C-631, C-632, C-633, C-634, C-635, C-636, C-637, C-638, C-639, C-640, C-641, C-642, C-643, C-644, C-645, C-646, C-647, C-648, C-649, C-650, C-651, C-652, C-653, C-654, C-655, C-656, C-657, C-658, C-659, C-660, C-661, C-662, C-663, C-664, C-665, C-666, C-667, C-668, C-669, C-670, C-671, C-672, C-673, C-674, C-675, C-676, C-677, C-678, C-679, C-680, C-681, C-682, C-683, C-684, C-685, C-686, C-687, C-688, C-689, C-690, C-691, C-692, C-693, C-694, C-695, C-696, C-697, C-698, C-699, C-700, C-701, C-702, C-703, C-704, C-705, C-706, C-707, C-708, C-709, C-710, C-711, C-712, C-713, C-714, C-715, C-716, C-717, C-718, C-719, C-720, C-721, C-722, C-723, C-724, C-725, C-726, C-727, C-728, C-729, C-730, C-731, C-732, C-733, C-734, C-735, C-736, C-737, C-738, C-739, C-740, C-741, C-742, C-743, C-744, C-745, C-746, C-747, C-748, C-749, C-750, C-751, C-752, C-753, C-754, C-755, C-756, C-757, C-758, C-759, C-760, C-761, C-762, C-763, C-764, C-765, C-766, C-767, C-768, C-769, C-770, C-771, C-772, C-773, C-774, C-775, C-776, C-777, C

LETTERS

Question of Size

I wish to take this opportunity to thank you for your most kind magazine. I have been an ardent reader of VO. The most true.

In reference to your article on the AFD Michael in your Aug. 22 issue, p. 39 (see last paragraph), that the AFD is the seedling and highest of U.S. air planes. I do not wish to take issue with you on this item, because I see no grounds on it. And I have been under the impression that the Lockheed F-104 is actually the smallest and lightest U.S. operational jet plane. This is based on figures I have and on book plates. They are or may not be correct, however. I should state in this.

| | AdP | P-104 |
|--------------|-----------|--------------|
| Wing Span | 27.5 ft | 22 ft |
| Gross Weight | 15,000 lb | 13-14,000 lb |
| Height | 15 ft | 13 ft 6 in |
| Length | 39.4 ft | 34 ft |

You will notice, that the only difference about the Starlight is greater is its length. The use, after our terminology of a being large or smaller in the overall pattern. I do not think so.

I also understood the F104 as well the latest happenings in the Greek media, responding all other demands we are here and even the highly unusual English (Thomas, 1991).

Richard M. Williams, Jr.
President, Williams & Morrow, Inc.

Army Plans Defended

The El Paso Chapter of the Association of the United Mexican Americans is presently a multi-group branch concerned with the Army Institute of the proximity of Ft. Bliss and also, concerned with the general welfare of the nation. As with so concerned on our editorial, "What Really Develops Mexico?" (Sept. 21) and Perspectives on Mexico" (Sept. 26).

Public interest in the nuclear program has definitely been stimulated by the TMI-2 accident and by the possibility of nuclear policies in the Department of Defense. We believe that public opinion influences these policies and our actions. We believe that statements made by a government and such socially responsible publications such as *Lawrence Weiss* should be useful and constructive.

Before entering any branch of the series of technical material or series of month branches, we should compare the dollar output per dollar of each branch.

The billiard table Arm has poured into lead concrete and masonry for its Nile Air system designed at the very least to drop piston-ringed burners over dust rings: a clever example of solution over, through shaped planning.²¹

This statement could be made only through extensive population coupled with complete systems of the Nile system which was planned as an open ended system capable of withstanding a variety of

Atlantic World welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Atlantic World, 338 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a precise identification. We will not print anonymous letters but names of writers will be withheld on request.

poison of working and untreated performance characteristics. The Noto, some on the past economic advantage of some mass release problems. Guidance on limited to work environmental and peak, peak problems and capable of untreated system is passed level. In combination of the threshold in 2000, which, for the 1990s, the system is connected from better than performance member delivery to work.

The success of this system has resulted from the team's freedom from fixation of narrow aircraft configuration propulsion guidance and control and from sufficient high cost of systems of limited application and rapid obsolescence. You may call this technological success, but not staged planning.

We, in, thought that the agency had "real progress in the development of procedures in other fields technical support is in demand on the effects of more to such agencies and industrial firms and we hope agency or technical group has a monopoly on development capability in one field of science.

[illegible]

Report Appreciated

The stars on the Nassi-Holler Report in the Sept. 30 issue (p. 54) is most relevant and encouraging. As a member of Mathematical Training Society, and one who is engaged in training work for the United States Air Force, I believe a real service has been rendered to readers of this report.

I understand that some persons in the Navy are attempting to make something out of the Indian contractors' entry on a Navy contract training. Aside from our basest interest in contract training, we have a deep interest in what the Navy does.

as the point. In opposing the common defense in the Heller Report, as the Navy is doing, one could ask: 'Is Navy putting Navy ahead of country?'

But the New, proven, flying team has been dramatically reduced and I wonder if the savings could not be even greater if the primary training periods were similar to that of the Air Force. In the Air Force, primary students receive 130 hr of flying during the first six months.

BARNETT HOWARD, President
Hawthorne School of Aeronautics
Minden, Ga.

Columbus Apologist

I imagine that about the same time that I was making it, H. M. Moulton's *Atlas* (AM, vol. 7, p. 148) with quite a bit of detail about this system, could have been followed by him, quite a few of the names that on Colombia I saw were given the same set of local Spanish and Greek-based ones; maybe a product is one thing, an alternative quality to it, which one's companies who also produce, creates competition is self-evident. So, it seems when he believed in a very low. The possibility of being a word in both of our languages, but in both, it is a key. I think, maybe, the word "Colombia" is a better preferred name, and gives a connection.

Spell It Out

The growing frequency of observations in *Advertiser* Week articles is beginning to distract from our readers' efficiency.

Members: Wages workers (WWA); independent engineers and architects (AIA); accepted negotiating isolation (NAES); also as familiar with documents like Armed Services Technical Information Agency (ASTIA), organizations like United States for Peace (USMP) and many of the major

absorbing substances (ASB) used in applications in our industry like the National Advisory Committee for Aeronautics (NACA) Blunt-nose cone model subjected to high speed flow, symbols (USPS) like NACA slip from the industry because this is USPS.

and special articles on cell metabolism (SAC), on GMPs in some of our RI. Through all GMPs in our RI on ARS and SAC, make references to ARS and SAC. SAC and usually abbreviated name.

I would like to make a special suggestion. My SS is that UFRS be presented so that SNA also is. MIES be considered when you see SSN so that MS and SNA are

post-PMUT/AM

* Please help form a united front
(W&L try—Ed)



SOLVES RELAY ENVIRONMENTAL PROBLEMS

Unique Balanced-Armature Relays meet all requirements of the most exacting operating environments—shock, acceleration, vibration and high temperatures.

In the Leach Balanced-Armature Relay, shock and vibration forces cannot move the relay armature. This eliminates faulty operation of contacts during extreme vibration and acceleration.



These Leach Rings meet or exceed requirements of MIL-R-5757, MIL-R-6106, MIL-R-5272. Typical ratings include: vibration, 20 G's to 500 cps (higher ratings available); shock and acceleration, more than 50 G's; temperature, -50° to +125°C; life, 50,000 continuous operations minimum at rated load, available on var, 115 vac, 400 cps operation. At night Leach 9226, 1.40x1.49 x 1.68 inches.

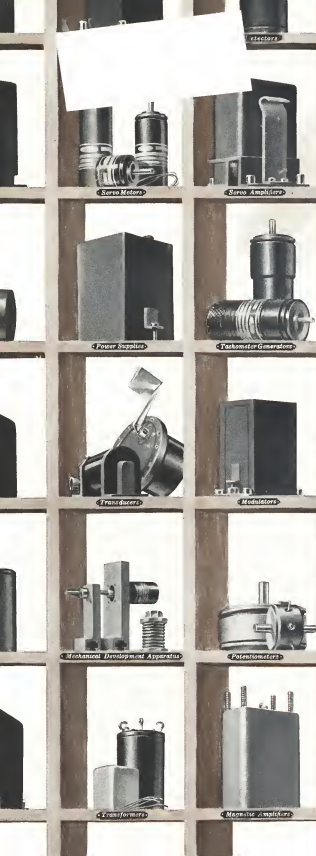
Leach has gained a unique reputation for creating reliable relays, custom-tailored to solve specific circuitry problems. Write for your copy of the Leach Balanced-Armature Relay Catalog.



LEACH

CORPORATION/LEACH RELAY DIVISION

5075 Avalon Boulevard, Los Angeles 3, California • District Offices and Representatives in Principal Cities of U. S. and Canada



CLOSE SUPPORT!

In close support of the ever-increasing performance and reliability demands of advanced missile and airframe weapon systems, Servomechanisms, Inc. Components Group is designing and producing an expanding line of products.

Typifying these advanced precision components are *Servo Motors, Tachometer Generators, Servo Amplifiers, Power Supplies, Modulators, Transducers, Potentiometers, Mechanical Development Apparatus, Miniature High Performance Transformers, Magnetic Amplifiers, Filters, Networks, Ice Detectors*, and other related products.

Advanced research projects investigating new materials for ultra-high temperature components as well as new miniaturization techniques are currently under way. The results, to date, hold great promise for the future.

Detailed knowledge of system requirements plus technological excellence, result in high performing and reliable components which assure system satisfaction. SMI's expanding Components Group will welcome your inquiries. For further data and catalogs write to: General Manager,



COMPONENTS GROUP

12500 Aviation Boulevard • Hawthorne, California

MECHATROL DIVISION, 625 Main Street, Westbury, L. I., New York

MAGNETICS DIVISION, 1000 West El Segundo Boulevard, Hawthorne, California

VACUUM FILM PRODUCTS DIVISION, 316 Washington Street, El Segundo, California